64

MAY 17 1915

THE HEATING AND VENTILATING MAGAZINE

Vol. XII. No. 4.
$1.00 a year. 10 cents a copy

NEW YORK, APRIL, 1915.

Publication Office:
1123 Broadway, New York

GURNEY HEATERS

FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER

GURNEY HEATER MANUFACTURING CO.

NEW YORK OFFICE 12 E. 42ND ST. 188-200 FRANKLIN ST. BOSTON.

THE "GLOBE" VENTILATOR

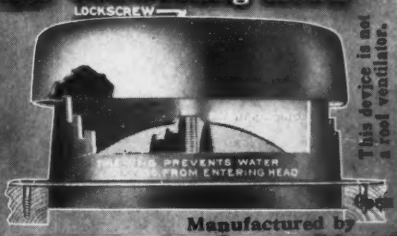
COPPER AND GALVANIZED IRON

SIMPLE, SYMMETRICAL, STORM PROOF, SUCCESSFUL

Model and Blue Print on Application

GLOBE VENTILATOR CO., TROY, N. Y.

Knowles Mushroom Diffuser and Air Controlling Head (Improved Notch Style) ADJUSTABLE



This device is set a roof ventilator.

Placed under seats in all auditoriums. A perfect Air Controlling Head and Diffuser, assuring *uniform distribution.*

Manufactured by

Knowles Mushroom Ventilator Co.

Successor to Geo. E. Knowles 9 Church St., New York

Telephone, Cortlandt 7811

AIR DUCT TEMPERATURES

Should be continuously recorded by means of

TRADE MARK

BRISTOL'S

REG. U.S. PAT. OFFICE.

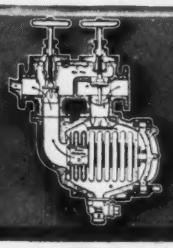
Recording Thermometers

THE BRISTOL CO., Waterbury, Conn

Branch Offices:

61 Liberty Street, New York — 1670 Frick Bldg. Annex, Pittsburgh, Pa.

753 Monadnock Block, Chicago, Ill.



ROSS FEED-WATER FILTERS

Will Keep Oil Out of Your Boiler

Regulating Valves for Water, Steam, Air

Ross Valve Mfg. Co. Troy, N. Y.

Ask for List of Users

MICHIGAN STANDARD TIN-LINED WOOD COVERING

FOR INSULATING UNDERGROUND STEAM PIPES

SIMPLE DURABLE EFFICIENT

THE MICHIGAN PIPE CO., Bay City, Mich.

Entered as second-class matter at the Post-Office in New York, N. Y. Copyright, 1915, by Heating and Ventilating Magazine Co.

Opportunity Talks No. 1

A Pennsylvania Business Block, Heated by Exhaust Steam from Central Station

There is Money for You in Central Station Heating

Hundreds of central station heating plants are today in successful operation in the United States and Canada.

WHY NOT IN YOUR CITY?

Send for our plan and let us tell you how to go to work to develop this proposition in your town. Now is your opportunity.

IN succeeding issues we will present in this space some of the important advantages of central station heating that have made this industry one of the most important in the United States and Canada

Write us at once and obtain the details of our plan

AMERICAN DISTRICT STEAM COMPANY
General Offices and Works - North Tonawanda, N. Y.

NEW YORK
West Street Bldg.

CHICAGO, ILL.
First National Bank Bldg.

SEATTLE, WASH.
Hoge Building

THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1915

The Edison Phonograph Shop

HEATING AND VENTILATION AT MINIMUM COST, WITH VENTILATION OF SOUND-PROOF BOOTHS.

BY C. E. DANIEL.

Most heating and ventilating apparatus dealt with in technical articles has been installed according to the best practice known to the heating engineer in charge. This is the case when there is the required space and the necessary appropriation. In many instances these things are not possible, making it necessary to locate the apparatus in space allotted by the architect and to make the installation conform to a limited appropriation. It is then necessary for the engineer to disregard practice and overcome the difficulties due to bad location of apparatus and building construction and make every dollar do the maximum amount of heating and ventilating where it is most required.

The apparatus here described was designed for and installed in the Edison Phonograph Shop under the last-named conditions. Aside from that, it has several points of interest in that it differs in many respects from the usual practice.

The building known as the Edison Phonograph Shop is located at 473 Fifth Avenue, New York City. It is of the reconstructed type, being formerly a residence with a second floor, which has been removed to make the first floor ceiling height twice what it was before the change. The first three floors are now devoted entirely to the sale and demonstration of Edison Diamond Disc phonographs. The fourth floor is to be let for offices, while the fifth floor will be used as a studio. The boiler room, fan room and shipping room occupy the basement.

From an architectural standpoint the interior decorations are of particular interest. This work consists of panelling, columns and architraves veneered with walnut, African mahogany, quarter-sawed oak and cherry. The first floor consists of a sales or show room in the front and a concert room in the back for demonstration of the operation of the phonographs. The second floor has the main office in the front with a record room and demonstration booths in the rear, as shown in the accompanying plan. All booths are of sound-proof construction and are used for private demonstration of machines or records. Three large booths, which are not shown in the plan, are located on the third floor.

MINIMUM HEATING REQUIREMENTS.

Comparatively little radiation was used in the building as none of the booths or concert hall has any glass exposure. The main store on the first floor is heated by an indirect stack located in the boiler room. Air is blown from the main heater through this stack and into

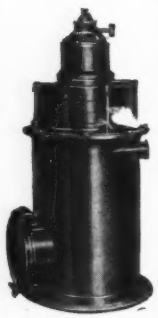
Potts-Seiders Supply Co., Columbus, O., jobbers of engineers, mill, mine, factory and plumbers' supplies, announces that John T. Seiders has now become active in the management of the company and plans are being carried out for a notable expansion of the company's business as jobbers of heating material and ventilating apparatus. The company's facilities now permit of prompt delivery of such material as well as maintenance of ample stock.

Charles T. Phillips, Pacific Building, San Francisco, Cal., consulting engineer, is desirous of receiving catalogues from manufacturers of heating and ventilating apparatus.

Kennedy Valve Mfg. Co., Elmira, N. Y., on May 1, will move its New York office to 81 John St. Thomas F. Cushing is manager of this branch.

Wanted.

Salesmen Wanted. Experienced salesmen wanted in every large city and territory to handle vacuum traps and high pressure expansion traps. State full particulars in answer. Address Box 10, care of Heating and Ventilating Magazine.



H.P.Equipment

Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

Send for catalogue

SPENCER TURBINE CLEANER COMPANY

HARTFORD, CT.

Dixon's Graphite
PIPE JOINT COMPOUND

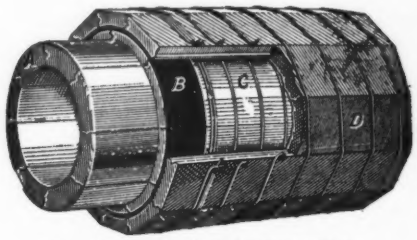
Is so far superior to red lead or white lead that there is no comparison.

Send for Booklet No. 211-D

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Co.

Established 1827



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

ELMIRA . . N. Y.

Chicago, Ill., 551 West 14th Place

THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1915

The Edison Phonograph Shop

HEATING AND VENTILATION AT MINIMUM COST, WITH VENTILATION OF SOUND-PROOF BOOTHS.

BY C. E. DANIEL.

Most heating and ventilating apparatus dealt with in technical articles has been installed according to the best practice known to the heating engineer in charge. This is the case when there is the required space and the necessary appropriation. In many instances these things are not possible, making it necessary to locate the apparatus in space allotted by the architect and to make the installation conform to a limited appropriation. It is then necessary for the engineer to disregard practice and overcome the difficulties due to bad location of apparatus and building construction and make every dollar do the maximum amount of heating and ventilating where it is most required.

The apparatus here described was designed for and installed in the Edison Phonograph Shop under the last-named conditions. Aside from that, it has several points of interest in that it differs in many respects from the usual practice.

The building known as the Edison Phonograph Shop is located at 473 Fifth Avenue, New York City. It is of the reconstructed type, being formerly a residence with a second floor, which has been removed to make the first floor ceiling height twice what it was before the change. The first three floors are now devoted entirely to the sale and demonstration of Edison Diamond Disc phonographs. The fourth floor is to be let for offices, while the fifth floor will be used as a studio. The boiler room, fan room and shipping room occupy the basement.

From an architectural standpoint the interior decorations are of particular interest. This work consists of panelling, columns and architraves veneered with walnut, African mahogany, quarter-sawed oak and cherry. The first floor consists of a sales or show room in the front and a concert room in the back for demonstration of the operation of the phonographs. The second floor has the main office in the front with a record room and demonstration booths in the rear, as shown in the accompanying plan. All booths are of sound-proof construction and are used for private demonstration of machines or records. Three large booths, which are not shown in the plan, are located on the third floor.

MINIMUM HEATING REQUIREMENTS.

Comparatively little radiation was used in the building as none of the booths or concert hall has any glass exposure. The main store on the first floor is heated by an indirect stack located in the boiler room. Air is blown from the main heater through this stack and into

the room from a register located under the front window, thus serving as a heating medium, as well as for ventilation. Concealed radiators are located under the front windows on the second and third floors, with the usual top and bottom registers for circulating the air over the radiators.

The registers are proportioned according to the rule: 4 sq. in. for top and 3 sq. in. for bottom registers, with an addition of 20 per cent. to the radiation because of reduced efficiency.

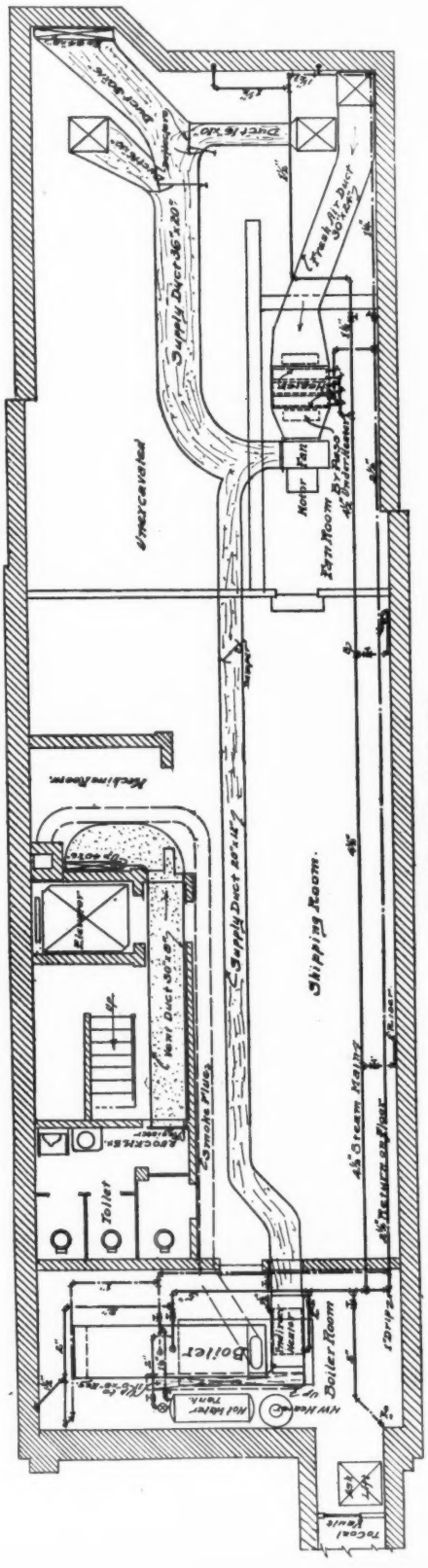
By heating the elevator shaft and stairway by a concealed radiator in the entrance hall, it was possible to supply all radiators, risers and main heater with one steam main and one return located on the south side of the building. By this arrangement, only 12 direct radiators were required, with a total of 660 sq. ft. of heating surface, including pipe coil. This is less than 1 sq. ft. of surface per 200 cu. ft. of building contents. All radiator and riser connections which are on a one-pipe system, were made one pipe size larger than the radiator or riser, except where risers were dripped.

The boiler and smoke breeching were covered with 1½-in. asbestos slab with a ½-in. air space and ½-in. hard plaster finish. All mains, branches and risers were covered with four-ply asbestos air cell covering and, in addition, the mains in the basement were sized with paper and recanvased with 8-oz. duct sewed on. All supply ducts, heaters and fan casing in the basement were covered with 1-in. asbestos air cell block and canvased.

NO OUTSIDE WINDOWS IN CONCERT HALL OR IN ROOMS CONTAINING DEMONSTRATION BOOTHS.

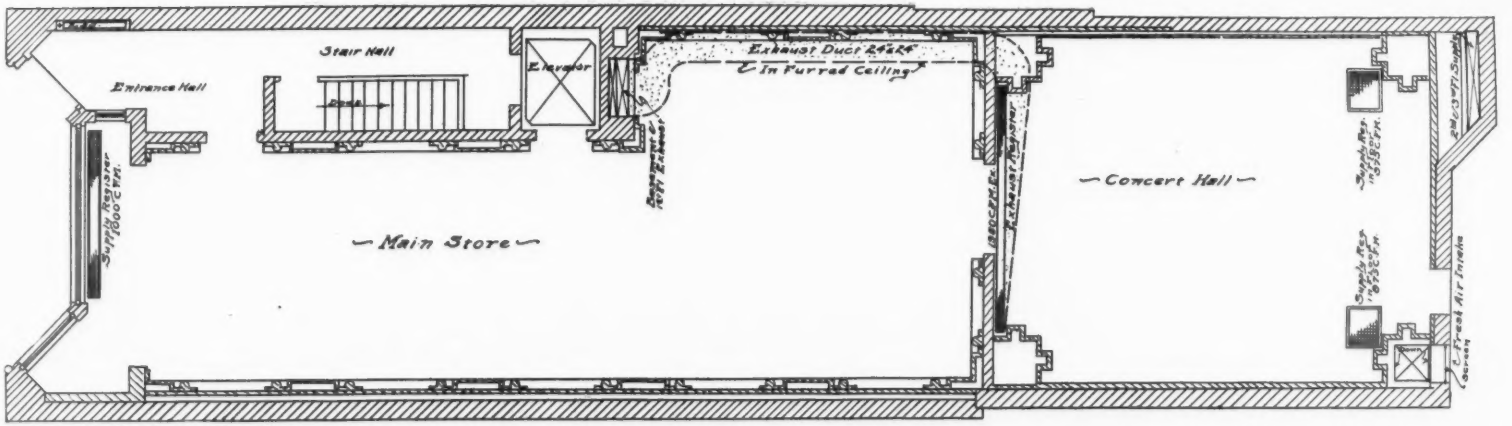
In order to get the best results from phonographs in the concert hall and demonstration booths it was necessary to make all partitions as well as outside walls, sound proof. Any sound passing from one booth to another would be as objectionable as that coming from the outside. This soundproofing eliminated any possibility of outside windows and, therefore, of natural ventilation, making forced ventilation necessary.

The concert hall has a seating capac-



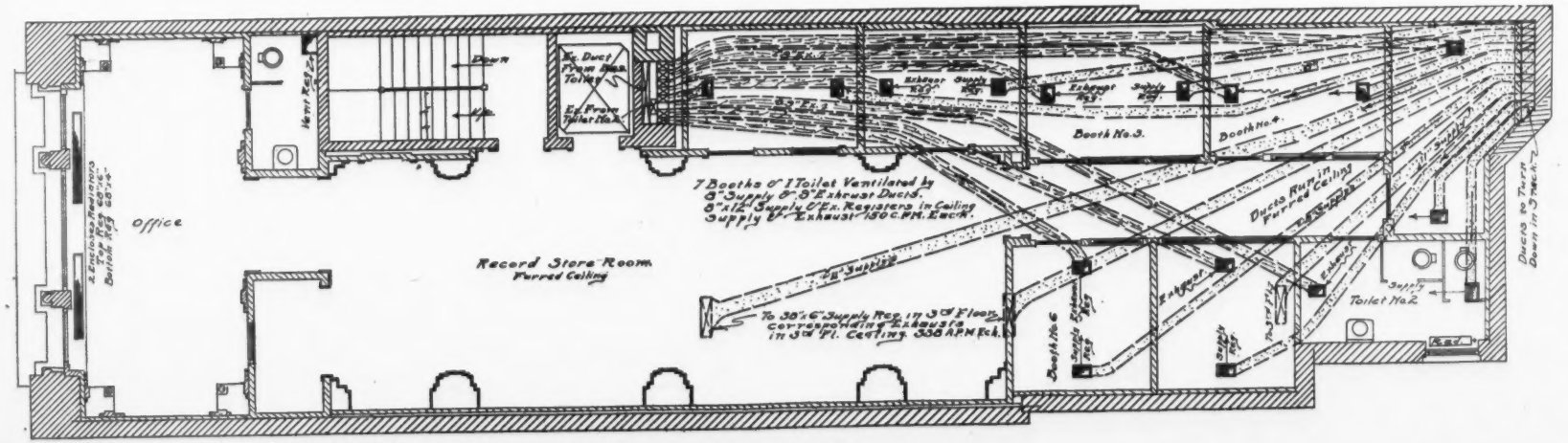
BASEMENT—PLAN.

ARRANGEMENT OF AIR SUPPLY AND EXHAUST SYSTEMS, EDISON PHONOGRAPH SHOP, NEW YORK.



FIRST FLOOR PLAN

FIRST FLOOR PLAN, EDISON PHONOGRAPH SHOP, SHOWING CONCERT HALL.


Down
Ex. Duct From Men's Toilet
Ex. From Toilet No. 2
Booth No. 3
Booth No. 4
7 Booths & 1 Toilet Ventilated by 9" Supply & 9" Exhaust Ducts. 3"x12" Supply & Ex. Registers in Ceiling Supply & Exhaust 150 C.F.M. Each.
Office
Record Store Room Furred Ceiling
Ducts Run in Furred Ceiling
To 30"x6" Supply Reg. in 3rd Floor corresponding Exhausts in 3rd Fl. Ceiling. 350 A.F.M. Ea.
Booth No. 6
Toilet No. 2
Ducts to Turn Down in Stack

SECOND FLOOR PLAN

ARRANGEMENT OF AIR SUPPLY AND EXHAUST DUCTS CONNECTING TO INDIVIDUAL BOOTHS, EDISON PHONOGRAPH SHOP.

ity of 65. The air supply was based on a purity of 8 parts of carbon dioxide to 1000 parts of air, with an assumed purity of 4.5 parts for outside air. Each occupant will exhale about 0.01 cu. ft. CO_2 per minute, so to maintain this purity $0.01 \div (0.0008 - 0.00045) = 28.6$, or 30 cu. ft. per minute will be required. Accordingly 1950 C. M. F. was allowed for this room on both the supply and exhaust systems. Under usual conditions this amount of air will give more than 30 C. F. M. per person, as this amount is based on the hall being filled to its capacity, and ordinarily will give greater purity than that stated above.

For the booths, it was not possible to determine the exact number of occupants, so the small booths on the second floor, which are 7½ ft. x 10½ ft. x 9½ ft., were given a five-minute air change or 150 C. F. M. This amount will maintain the standard of purity set for the concert hall when an operator and four customers are occupying the same booth. A six-minute air change was given the third floor booths, which are 12 ft. × 18 ft. x 9 ft., and at that rate 330 C. F. M. each is required. This amount was also allowed for on the exhaust system, thus giving 30 C. F. M. to each ten customers and one operator.

The second floor toilet, which is of practically the same size as the smaller booths, was given a supply of 125 C. F. M. and an exhaust of 150 C. F. M.; the exhaust being made greater than the supply in order to obviate any possibility of foul air leaking into the corridors. For the same reason the basement toilet was given an exhaust of 250 C. F. M. with only a grille in the lower panel of the door for a supply.

In the case of the first floor store, which is treated hereafter, the heat required and the temperature of the air supply determined the amount of air as the number of occupants is small and constantly changing.

FIGURING TEMPERATURE OF AIR SUPPLY.

The temperature of the air supply from the main heater was determined by the temperature loss from the air in travelling from the fan to the second floor ceiling, where the air is distributed to the various rooms. As but one of the booths has a wall exposure, which is very small, the temperature of the air supply at the register was set at 70° F., thus making the required air temperature at the fan 70°, plus the drop in temperature of the air while passing from the fan to the second floor ceiling. The main supply stack has an exposed wall area of 224 sq. ft. and an air velocity of 700 ft. The transmission factor for the usual 12-in. unfurred brick wall is 0.318 B. T. U. per degree difference of temperature. If the velocity of the circulating air in a room is assumed to be 80 ft. per minute down the wall and the transmission factor varies as the square root of the velocity of the air, this gives a transmission factor for the outside wall of the duct of 0.9 B. T. U. per hour per degree difference in temperature, when the velocity of the air is 700 ft. per minute. From this it was determined that the duct would radiate 224 sq. ft. x 0.9 B. T. U. x 75° = 15,000 B. T. U. per hour.

To supply this radiation it was necessary to raise the temperature of the 2200 cu. ft. of air 6° above the temperature desired or to 76° F. as may be seen from the following:

$$\frac{15{,}000 \text{ B.T.U.}}{2200 \text{ F.P.M.} \times 60 \text{ min.} \times 0.02} = 5.7 \text{ or } 6°$$

As booth No. 5, on the second floor, has an exposed wall area of 80 sq. ft., its temperature was made slightly under that of the other rooms, but not enough to warrant extra radiation. To heat to 70° F. the main concert hall, which has 800 sq. ft. of exposed wall and 21 sq. ft. of exposed door, requires 16,000 B. T. U. per hour. As stated above the air supply to this room is 1900 C. F. M. and when

$$\text{heated } \frac{1600 \text{ B. T. U.}}{1915 \text{ C.F.M.} \times 60 \text{ min.} \times 0.02} = 7°$$

above the room temperature supplies the necessary heat.

As the temperature of the air supply is only 76°, this makes the room temperature slightly over 69° when the other rooms are at 70°.

SEPARATE INDIRECT RADIATOR TO HEAT MAIN STORE.

As previously mentioned a screw pin indirect radiator was installed at the point shown in the boiler room to supply the necessary heat to the main store, which has 280 sq. ft. of glass and 300 sq. ft. of exposed wall, equivalent to 60,000 B. T. U. per hour. Assuming a maximum temperature of 120° F. for the air supply

$$\frac{60{,}000 \text{ B. T. U.}}{60 \times 0.02 \times (120° - 70°)} = 1{,}000 \text{ C.F.M.}$$

required to supply the heat. The coefficient of transmission for the school pin radiator was taken as equal to 5 B. T. U. per degree difference of temperature per hour with an air velocity of 500 ft. per minute through the radiator. The difference in the average temperature of air and steam being 112° F., this made the heat delivered, per square foot of radiator, 560 B. T. U. per hour. Of the required temperature rise above 70° F., 6° was supplied by the main heater, making the necessary heat to be delivered to the air by the indirect, 52,800 B. T. U. To deliver this amount of heat 94 sq. ft. of surface was required, so the nearest size, 100 sq. ft. was installed. This heater was connected on a two-pipe system with an air by-pass the full size of the supply duct.

DESIGN OF APPARATUS FOR HEATING THE AIR SUPPLY.

To heat the air supply, Vento heaters were used with an air velocity of 1,000 ft. per minute through the stacks. With this velocity, the total amount of air to be heated, 52,000 cu. ft. per minute, required 5.2 sq. ft. of free area. From the Vento tables, it was determined that with standard 5-in. spacing, three stacks would heat the air from 0° to 86° F., a temperature which is higher than is required but which will be necessary later if an air washer is installed as contemplated.

A three-stack heater, with nine sections per stack, having 291 sq. ft. of heating surface, was installed at the point indicated. Each stack of the heater was valved separately so that by using these valves in connection with the air by-pass any desired air temperature may be obtained.

For determining the size of such heaters, various formulas have been advanced, but the tables compiled by the different heater companies have been found much more convenient for practical application.

DUCTS.

For the air distribution, a combination of the trunk duct system and the branch duct system was used, with a main supply duct in the basement and main supply and exhaust stacks branching to the various registers in furred ceilings. Under ordinary conditions the trunk duct system would have been used throughout but for ventilating the sound-proof booths it was not feasible to make the branch ducts short as they would serve to transmit sound through the main duct from one booth to the others. To obviate any such tendency all branch ducts were constructed of No. 22 gauge galvanized iron and covered with ⅛-in. asbestos mill board, wired on and run separately to the main stacks. All the large ducts in the basement were constructed of No. 24 gauge galvanized iron and braced with angle irons.

The main vertical supply and exhaust stacks were formed in the building construction, with the branch supply ducts turning down and the branch exhaust ducts up, in their respective stacks. In the case of the toilet exhausts, the branches were carried up separately to the fan to prevent odors from being carried from the toilets through the branch ducts to the booths, when the fan was not running.

The velocity in the small ducts was taken at 500 ft. per minute for the supply and 400 ft. per minute for the exhaust. The velocity in the main supply duct was made 1,000 ft. per minute and 700 ft. per minute in the vertical supply stack, while 900 ft. per minute was necessary in the vertical exhaust stack, because of the building construction.

For the supply system the greatest friction was from the fan through the small ducts to booth No. 1. This included 45 ft. of 8-in. pipe, with three elbows, at 500 ft. velocity; a 36 ft. ver-

tical stack at 700 ft. velocity and 24 ft. of horizontal duct, with three elbows, at 1,000 ft. velocity, which is equivalent to a friction head of 0.15 oz. static pressure. This friction is usually taken from tables, but where tables are not available the formula, $P=\frac{KSV}{A}$ is used where

P = pressure loss in ounces per square inch.

S = friction surface in square feet.

A = area of duct in square inches, regardless of shape.

V = velocity in feet per second.

K = 0.00012 and 0.00022 for galvanized and brick ducts, respectively.

For elbows the radius of the throat was made equal to the width of the duct. When this is true the friction of an elbow is equivalent to a straight pipe of the same diameter with a length equal to ten times the diameter of the elbow. According to Vento tables, the friction of the air at a velocity of 1,000 ft. per minute through the heater is equal to 0.1 oz. per square inch and the friction in the fresh air intake is equal to 0.035 oz. per square inch, making the total friction for the fan to overcome equal to 0.28 ounces per square inch.

Deflectors or dampers were set in all branch ducts so that the air supply might be regulated. Because of the higher velocity in the exhaust stack the irregularity of its walls and a slight leakage into the exhaust duct, the friction in the exhaust system was found to be a little higher than that of the supply system, although the two systems were designed to have the same friction. This was overcome by slightly increasing the speed of the fan.

The supply and exhaust fans have wheel diameters of 30 in. with their speeds set at 266 and 300 R. P. M., respectively. The supply fan is located at the point shown in the basement plan, while the exhaust fan is set in an air-tight pent house on the roof, directly over the vertical exhaust stack, to discharge onto the roof through a weather hood. The control of the exhaust fan is located in the basement with an ammeter in the main circuit, as required by the Fire Underwriters, where a motor is not visible from the starting box.

In zero weather the main heater will condense 1.84 lbs. of steam per hour per square foot, which is equivalent to 1.84×291 sq. ft. × 961 B. T. U.=520,000 B. T. U. per hour for the entire heater. The indirect in the boiler room will require 52,800 B. T. U. per hour, while the 660 sq. ft. of direct radiation will radiate 184,800 B. T. U. per hour, making a total of 757,600 B. T. U. per hour. Adding 10% for radiation from mains, etc., this brings the total to 833,260 B. T. U. per hour to be supplied by the boiler.

The hot water heater, which was designed to heat 100 gal. of water per hour from 50° to 180° F., requires 105,000 B. T. U., thus making the total load on the boiler 938,260 B. T. U. per hour, which is equivalent to 28.3 H. P. To supply this load a 30 H. P. horizontal, portable, fire tube boiler was installed, the rating being based on 10 sq. ft. of heating surface per horse power.

NEED OF AIR WASHER APPARENT.

Originally an air washer was contemplated which required a higher supply fan speed than that of the fan installed. On account of the extra cost of the air washer it was omitted and the fan controller changed to reduce the fan speed to conform to the new friction head. The dry air, with more or less dust which has been blown into the building, has caused quite a little damage to the interior wood decorations and the installation of an air washer is under consideration at the present time.

The installation has been operating during the present winter and has just been passed as meeting all the heating and ventilating requirements specified and mentioned above.

The work was installed under the direction of Shape and Bready, architects, and J. F. Musselman, consulting engineer, New York.

PLANT OF THE EXCELSIOR MOTOR & MANUFACTURING CO., CHICAGO.

A Factory Building Equipped With Outside Air Ducts

PLANT OF THE EXCELSIOR MOTOR AND MANUFACTURING COMPANY, CHICAGO.

In the new plant of the Excelsior Motor and Manufacturing Company at Chicago, designed by John Ahlschlager Son & Co., of that city, there are some unique features of design, of which the lighting, heating and ventilating equipment is not the least. The plant is situated on Lawndale Avenue, extending the full depth of the block from Cortland Street to the C. M. & St. P. tracks, and is six stories high with a main building 80x576 feet and an extension at one end of 50x50 feet. Connected with the plant there is a powerhouse containing two 600-horsepower boilers and two direct-connected Corliss engine driven main generating sets with auxiliaries, brick stack and coal handling equipment, the arrangement of all of which is shown in one of the accompanying photographs.

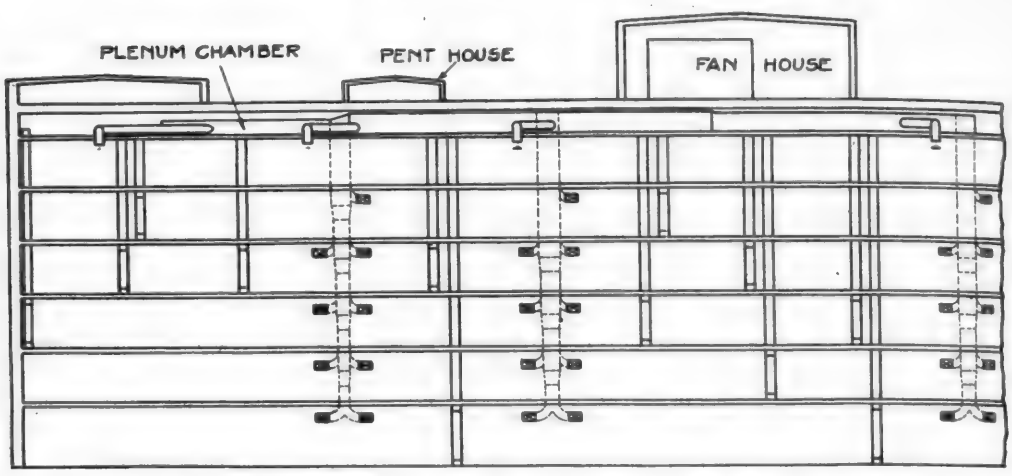
LARGE PERCENTAGE OF GLASS AREA.

The building is a monolithic structure of reinforced concrete in skeleton form with solid steel sash extending from column to column and from girder to girder. This method, as far as the engineers have been able to learn, made it possible to allow a larger per cent. of glass area to floor area than any building on record. The total glass area is 78½ per cent. of the outside walls. The plant will be devoted to the manufacture of motorcycles, the two lower floors being used for the repair and machine shops, the third floor for polishing, the fourth floor for assembling, while for the present the fifth and sixth floors will be used for storage.

AIR DUCTS CARRIED DOWN ON OUTSIDE OF BUILDING.

The owners' instructions were to maintain in the building operating conditions with respect to temperature and humidity that would promote the best efficiency, and it has proven the truth of the new economic principle "that which is best for the workmen, is best for the employer." The heating, ventilating and air washing equipment is in two units at the roof level, each consisting of one No. 15 double width Niagara Conoidal fan, belt-driven from a 50-horsepower variable speed motor, heating coils and Carrier air washers equipped with automatic humidity control. Each unit has a normal capacity of 144,000 cu. ft. of air per minute, affording an average air change of four times per hour.

The space between the roof and the sixth floor ceiling is used as a return plenum chamber. Through this are carried the supply ducts from the apparatus as shown in the plan of plenum chamber. These supply ducts except for the sixth floor, which is taken care of by branch pipes extending down through the ceiling, are carried down the outside of the building to the first floor by seven main



CROSS SECTION OF END OF BUILDING, PLANT OF EXCELSIOR MOTOR & MANUFACTURING CO.

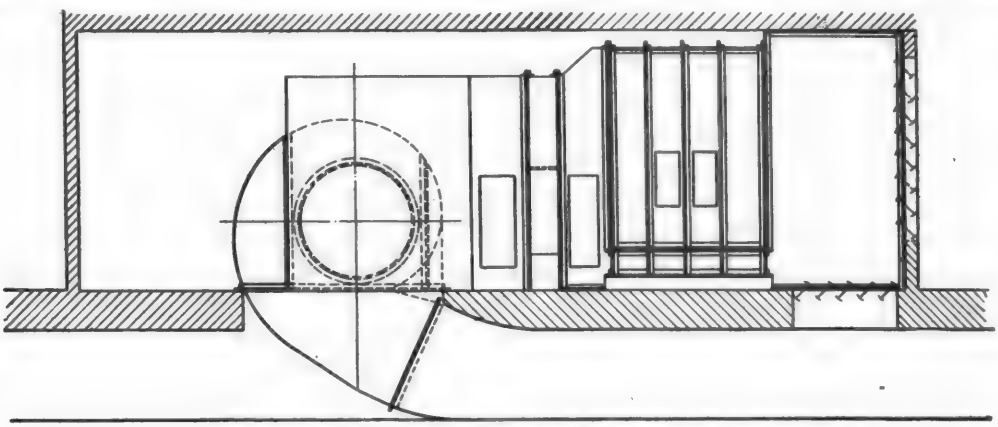
stand-pipes, which are of heavy gauge galvanized iron. These stand-pipes with their branched outlets are entirely enclosed and protected by concrete stacks having 6-inch walls and air space between them. The supply of air is introduced along the west side of the building near the ceiling levels. All outlets have hand control dampers and diffuser plates to deflect the air uniformly at from 800 to 900 feet entering velocity.

ARRANGEMENTS FOR RECIRCULATION.

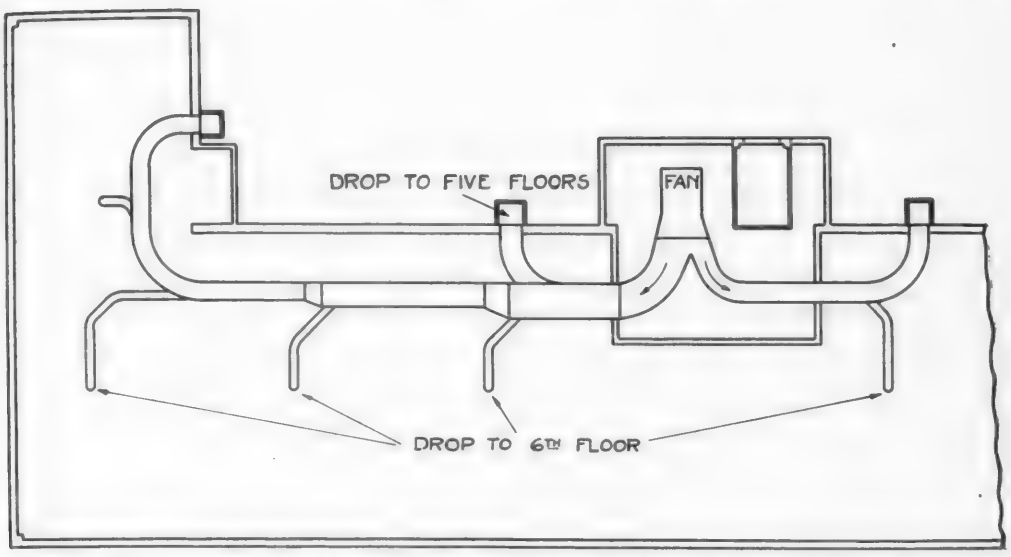
To provide ventilation and, if desirable, recirculation of air from each floor independently, vertical galvanized iron air ducts are uniformly spaced around the entire building on each side of the columns, which project 12 inches into the room. The ducts are 12x20 inches, and it will be seen from the sectional elevation that separate ducts are carried to each floor with openings at floor and ceiling which are finished with wire screens and dampers. This arrangement permits the air to be exhausted from either floor or ceiling level, depending on the season and whether cooling or heating is desired. The tops of these exhaust ducts extend 18 inches above the sixth floor ceiling into the return air chamber, and each is fitted with an automatic fire damper. By this method there is no possibility of fire communicating from floor to floor.

AIR WASHERS SPECIALLY DESIGNED FOR COOLING.

The air washers are Carrier Type "B" machines, which are designed specially for cooling, and throughout the warm weather are designed to reduce the temperature of the air to that of the outside wet bulb thermometer, which in Chicago rarely exceeds 76 degrees F., and is usually much lower, even through the



ELEVATION OF APPARATUS IN FAN ROOM ON ROOF.

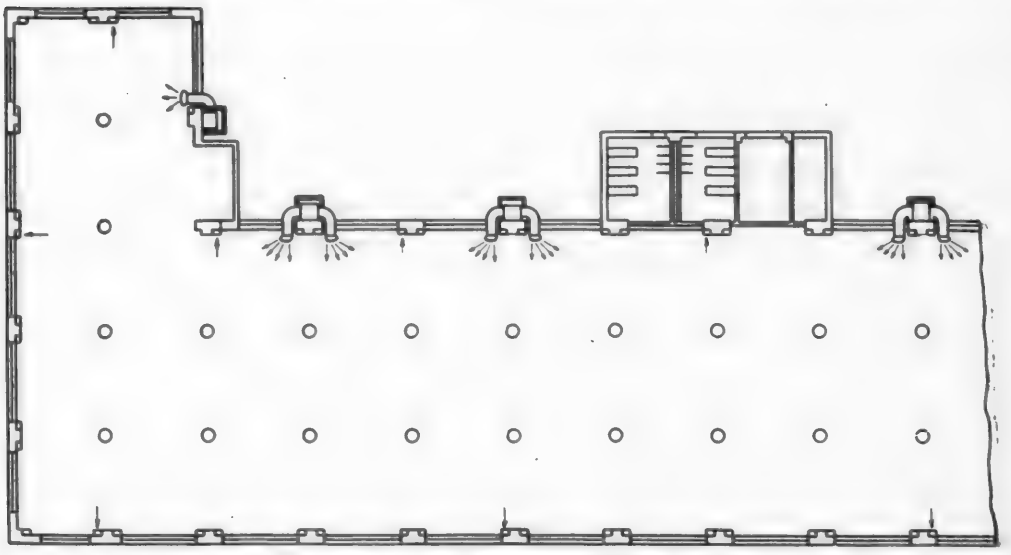


PLAN OF PLENUM CHAMBER, PLANT OF EXCELSIOR MOTOR & MFG. CO.

hottest periods. As outdoor air exclusively will be used in the summer, the temperature of the air delivered to the workrooms in that case will be that of the outside wet bulb temperature plus the temperature rise due to friction and the transmision of external heat, which it has been carefuly calculated will not exceed 3 degrees.

In addition to the main sprays, flooding nozzles extend the full width of the air washers, and are located directly above the first four corrugations of the eliminators. These flooding nozzles keep a constant flow of water over the surface of the plates, keping them clean and maintaining a high washing efficiency without any perceptible increase of moisture content of the air.

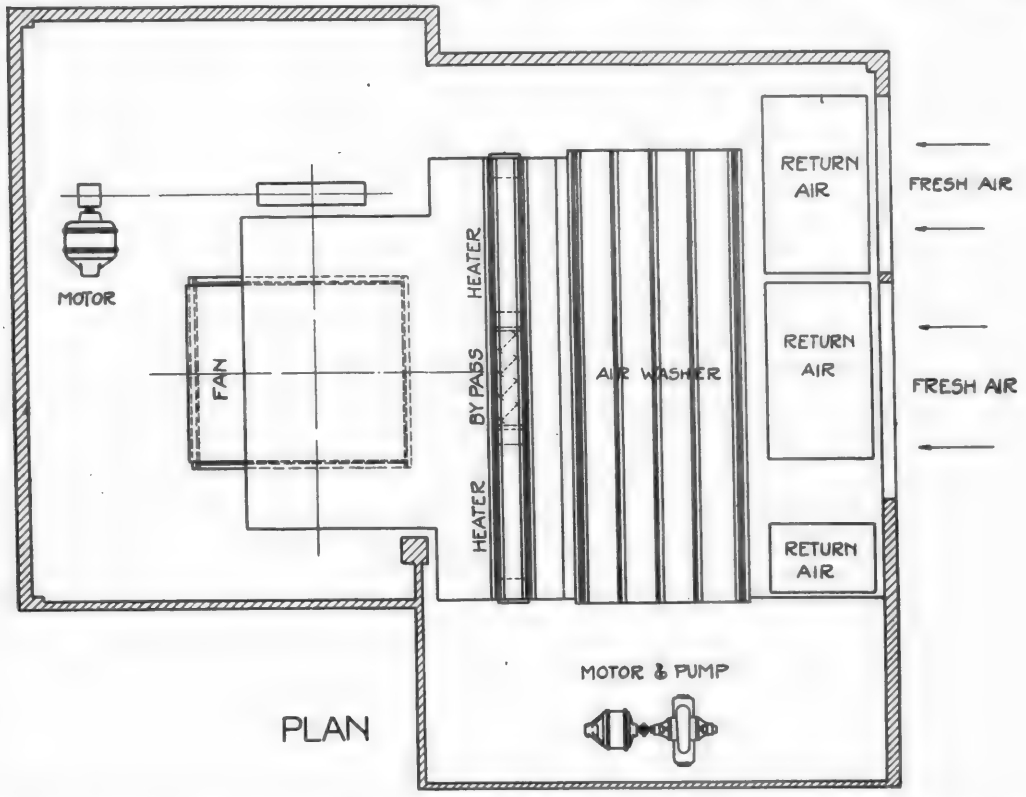
Considerable weight was given in the selection of the air washers to this feature, and to the unusually large amount of washing surface provided. There are two banks of spray nozzles, which may be operated separately if desired, and the spray water is recirculated by direct-connected 6-inch centrifugal pumps, each of the double suction type with hori-



TYPICAL FLOOR PLAN. PLANT OF EXCELSIOR MOTOR & MFG. CO.

zontally split shells, made by the Buffalo Steam Pump Company and driven by 20-horsepower motors. Each air washer is 25 feet wide and 13 ft. 2 in. high, requiring the circulation of 42,500 gals. of spray water per hour.

The coils are cast-iron Vento radiation placed betwen air washers and fans, and two stacks high with by-pass areas for use in summer. As direct radiation is provided for heating, the indirect stacks are proportioned so as to raise the air temperature from 40 to 85 degrees, the air being heated to 40 degres under extreme conditions by means of the Carrier automatic humidity control. In moderate weather the use of direct radiation has been found unnecesary.



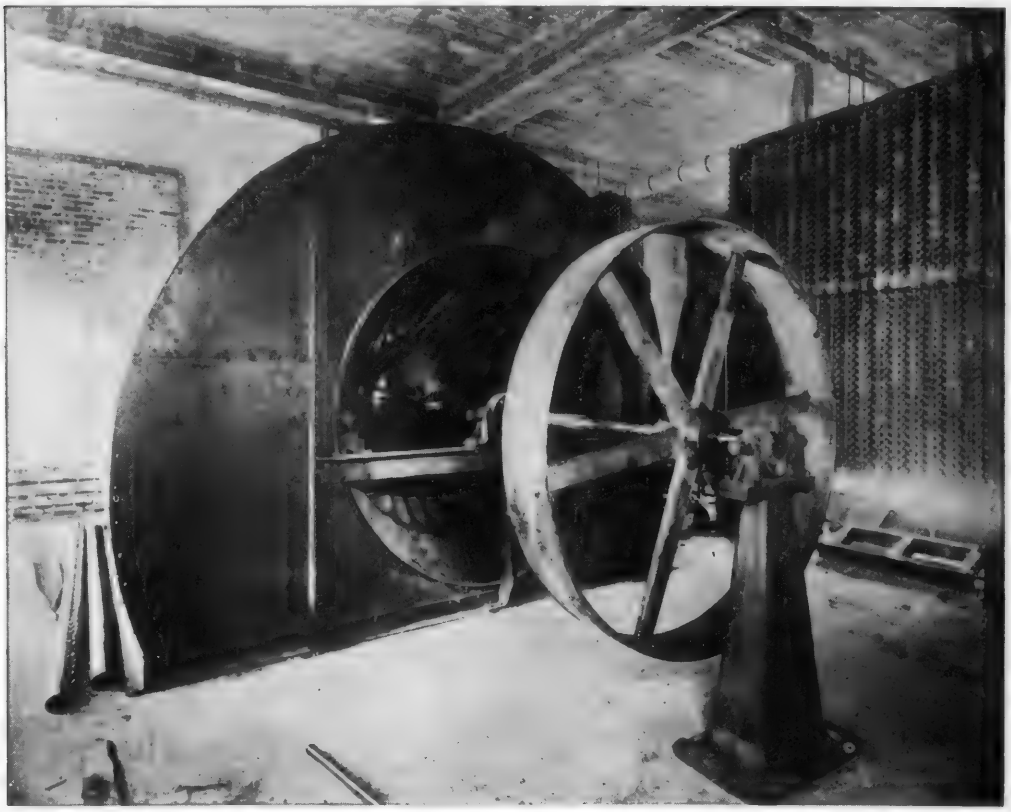
PLAN OF FAN AND HEATER APPARATUS, PLANT OF EXCELSIOR MOTOR & MFG. CO.

UNIQUE METHOD OF REGULATING HUMIDITY AND TEMPERATURE.

The operation of the humidity and temperature regulation is distinctly new, and takes advantage of the fact that the ventilating system will supply an amount of air very greatly in execess of the standard requirement of 30 cu. ft. per minute per occupant, also that any part of this air which is recirculated will first be thoroughly washed and cooled. This partial recirculation takes place whenever the outside wet bulb temperature is below 40 degrees F. in the following manner:

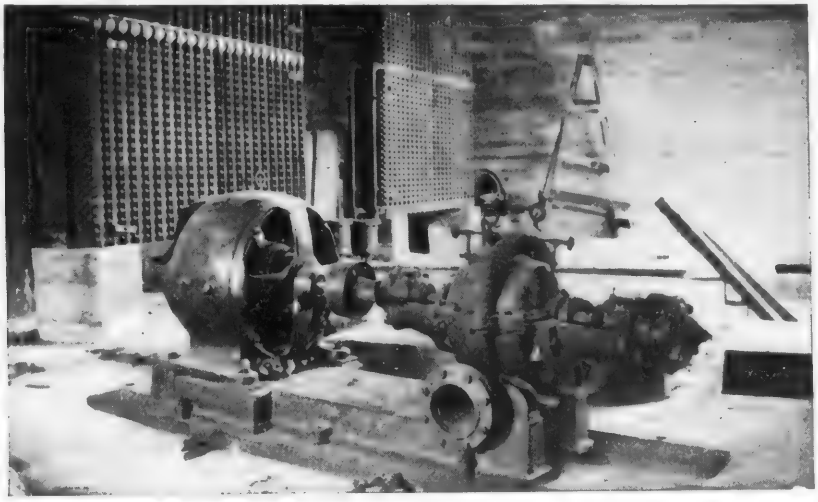
The two pent houses on the roofs are skeleton structures, as shown in the small photograph, with louvre dampers on all four sides operated by air motors in the same manner as the fresh and return air dampers in the fan houses. These are all linked together, automatically controlled by Carrier graduated action thermostats, using compressed air as the motive power for their operation, and this control is adjusted so that the correct proportion of fresh and return air is taken into the apparatus for maintaining a constant saturated temperature or dewpoint leaving the air washer. The louvre dampers in the pent houses and return air dampers in the floors of the fan houses both open directly into the return plenum chamber and operate in a reverse direction, so that, for instance, when the outside temperature drops, the control calls for more warm air, the

ONE OF THE AIR WASHERS ERECTED, PLANT OF EXCELSIOR MOTOR & MFG. CO.



FAN AND HEATER UNDER ERECTION, PLANT OF EXCELSIOR MOTOR & MFG. CO.

fresh air dampers and the pent house dampers partly close, while the return air dampers open up a sufficient amount to permit more warm air from the building to enter the air washers. No tempering coils are provided, as the automatic control of the entering temperature makes them unnecessary.



ONE OF THE SPRAY PUMPS, SHOWING VENTO HEATERS IN BACKGROUND.

There is found to be a great deal of economy in this method of regulating the humidity and temperature, since in extreme weather the use of tempering

AIR INTAKES AND DIFFUSERS, PLANT OF EXCELSIOR MOTOR & MFG. CO.
(See branch connections outside window.)

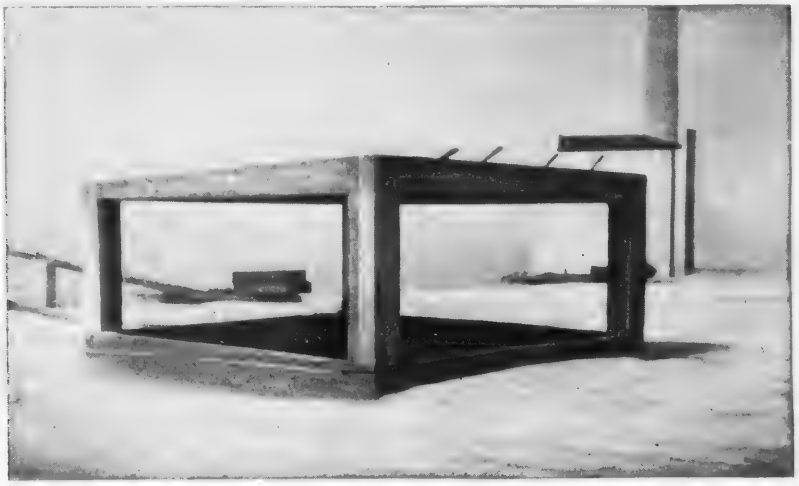
ROOF, PLANT OF EXCELSIOR MOTOR & MFG. CO., SHOWING PENT HOUSES AND FAN HOUSES WITH AUTOMATIC DAMPERS.

coils instead of return air would require 350 horsepower of steam additional. The saving due to omission of the coils, additional boiler power, and cost of installation is several times the cost of the automatic humidity regulation.

The use of the outside concrete ducts for a building of this size and construction is novel, but the calculations for heat radiation, and the precautions taken to prevent excessive losses, have proven entirely successful, while the freedom from interior obstruction which this arrangement affords is of much greater value than the extra cost of the ducts.

The addition of exhaust ducts and the double system of registers at floor and ceiling is another feature which, though not yet tested through a summer season, will be of inestimable value as a means of insuring good ventilation and thorough distribution of air. In winter the registers at the floor will be open, so as to induce a downward movement of air and prevent stratification, while in summer rapid circulation and escape of warm air will be insured by closing the floor registers and opening those at the ceiling.

It may be added that this plant operating with the system as here described, although not yet fully organized or equipped, is turning out 150 motor-cycles per day. It is designed to accommodate a working force eventually of 2,500 to 3,000 men.



SKELETON OF PENT HOUSE, WITHOUT DAMPERS.

The Vento radiation was furnished by the American Radiator Company of Chicago, the fans by the Buffalo Forge Company of Buffalo, N. Y., and the air washers by the Carrier Air Conditioning Company of New York.

The Relation of the Architect and the Engineer

II.

By D. D. Kimball.

President, American Society of Heating and Ventilating Engineers; Member, New York State Commission on Ventilation.

(Read before the Pittsburgh Chapter American Institute of Architects, and here first published.)

An incidental, but very great, advantage of the employment of the engineer lies in the assurance of safety in undertaking separate contracts for the building and its equipment. I am well aware of the great diversity of opinion among architects as to the wisdom of separate contracts. A survey of this problem leads me to the conclusion that the separation of the building and equipment contracts is rapidly and deservedly coming to the front. Three States already have laws calling for the separation of contracts on all State, county or city work and others will doubtless rapidly follow. This will have its effect on the general practice.

The attitude of the general contractors in opposition to such course is well known. It is only natural that they should use any legitimate means to increase the amounts of their contracts. It is customary for them to state that the total cost of the work is no greater in case of the general contract. But the heating, electrical, plumbing and other trade contractors will make just as low prices to an owner as they will to a general contractor. In fact many of the best contractors will make lower prices to an owner than to a general contractor, for they have become thoroughly annoyed at the customary practice of the general contractors of shopping the bids of subcontractors. They realize that after submitting the first bid they will be called upon for a reduction in the amount of their bid after the general contractor has his contract, and for this they provide by making their first bid high. Thus the owner pays a higher price for the equipment than would otherwise be the case.

But recently a large heating contractor told an architect in my presence that he would always bid 5% less to an owner than to a general contractor. In another case a plumbing contractor offered to reduce a bid already made by 3% if the owner would contract direct rather than through a general contractor.

The claim that the general contractor can secure a lower price because of the volume of his business is a fallacy. The equipment contractors prefer to bid direct and the advantages to him of so doing warrant a lower price. The volume of business available to the equipment contractors is the same in either case.

A general contractor may state that he places a lower percentage of profit on the work if he includes within his price the amounts of these sub-contracts, but this is not believed to be a fact, for the remaining portion of the general contract is for the most part a grouping of subcontracts and competition can well be depended upon to keep down the percentage of profit on the part of the general contractor. In any case what slight difference the general contractor can make in his percentage of profit will still leave an advantage in favor of the separate contracts.

A frequent objection made by the architect to separate contracts is that there is a difficulty in placing responsibility for the progress of the work, one contractor blaming the other in case of delays. Surely the architect and engineers are equal to the solution of these difficulties, involving only the placing of responsibility for each detail of the work upon the proper contractor.

I am thoroughly familiar with both methods of procedure and I never have found an instance of serious difficulty in conducting work by means of separate contracts. There is a very decided advantage in being able to deal directly with, and in being able to control, the

sub-contractors. There is also a material saving in the amount of labor in administering the details of the work, the prevailing opinion to the contrary notwithstanding.

In the case of the general contract all instructions have to go from the architect to the general contractor, thence to the sub-contractor, the reply goes from the sub-contractor to the general contractor and thence to the architect, while in the case of separate contracts the architect can deal directly with every contractor with a material saving in time.

The indirection of communication in the case of a general contract will be found to have a serious effect on the cost of extra work.

There is also the advantage of that direct choice of sub-contractors which insures the selection of only the highest grade contractors, those whom the architect and owner know and those in whom they have confidence.

Another reason for the higher sub-contractors' prices when the sub-contracts are made a part of the general contract is the delay to which the sub-contractor is subjected in receiving his payments. In relatively few cases does the general contractor turn over to the sub-contractor his proper proportion of payment received. In effect, therefore, the sub-contractor is largely financing the general contractor and he naturally charges for this service.

But the architect may say "if you propose to divorce the heating, electrical and plumbing work from the general contract why not the steel work, fireproofing, plastering and other portions of the structure." A reasonable answer to this would be that while a building without the heating, lighting and plumbing would not be a comfortable or convenient building to occupy, it would still be structurally complete and the relation of the sub-contractors having to do with the carpentry, plumbing, plastering, etc., are much more intimate than in the case of the sub-contractors for the heating, lighting, plumbing and general building trades sub-contractors. In other words, there is a line at which an entirely reasonable separation can be made without injury to anybody and with advantage to the owner and architect.

In several cities the heating, plumbing or electrical contractors' associations have passed resolutions declining to figure work for general contractors. In such cases the general contractors are not able to secure sub-bids from the best heating, electrical and plumbing contractors.

WHEN ENGINEERING SERVICES SHOULD BE EMPLOYED.

It is granted, without argument, that heating, plumbing, electrical and similar work in small buildings, such as small houses, police and fire stations, small stores and small office buildings are not these upon which consulting engineering services are required, for the reason that any architect's office should include in its staff someone sufficiently well acquainted with the details of these systems to enable the architect to prepare a satisfactory set of plans and specifications for this simple work.

However, all work involving intricate problems, including such buildings as hospitals, hotels, schools, theatres, large store and office buildings, mercantile establishments, large residences, and any building involving power, refrigerating, pumping or other complicated plants should be the subject of engineering advice.

Any work the preparation of plans and specifications for which is beyond the ability of the personnel of the architect's staff, independent of advice from a contractor's or manufacturer's engineer, should be consigned to the care of the independent consulting engineer.

The distinction between the two classes of buildings cannot be well based on the cost of the building for some large buildings involve very simple problems of heating, lighting and plumbing, while, in other cases, small buildings, especially hospitals, hotels and schools, involve intricate problems in the design of the equipment.

PAYMENT TO THE ENGINEER.

There is no respect in which the work of the engineer is less expensive proportionately than the work of the architect, and the education, training and experience of the engineer is quite as extensive and expensive as that of the average architect. In proportion to the amount of the fee paid to the engineer the cost

of the engineer's plans and specifications is quite as great as the cost of the plans and specifications of the architect, and the cost of the work upon which the engineer's fee is based is much smaller than the cost of the work upon which the architect's fee is based. Why, then, should not the engineer be paid as high a rate as the architect?

It is admitted that it is customary among engineers to charge a smaller fee to the architect than to the owner when the architect is to no extent reimbursed, or in effect, give to the architect a discount as a wholesale customer. This is due principally to the recognition of the fact that the architect may not be asked to pay all his fee on that part of the work given to the engineer, for as stated above, the architect is involved in considerable cost in carrying on the administration of this work. This reduction of the architect's fee is unreasonable and is but added chaos to an unscientific basis of architectural and engineering fees.

Therefore, if the architect receives 6% on a piece of work the engineer should also receive 6% upon his portion of the work, or if the architect receives 5% the engineer should also receive 5%.

Some architects are in the habit of asking owners to pay 5% or 6% extra on the cost of the engineering equipment where engineering services are employed. Others ask the owner to pay 2½% or 3%. I have discussed this matter with many architects and in the majority of cases there is an agreement of opinion that while the owner directly receives the benefit of the engineering services and may, therefore, be reasonably asked to pay the extra cost to the architect, there is no justification for asking the owner to pay a full 5% or 6% extra, for the architect is certainly saved some expense in the making of plans and specifications and supervision of the work, and he is not called upon to give of special training, experience or knowledge on this work.

If the owner pays the architect 6% on the cost of the complete structure, including the engineering equipment, and is then asked to pay 6% extra on the cost of the engineering equipment for the services of the engineer, he is somewhere paying for more than he is getting, for is it not true that not both the architect and engineer are called upon to give the same knowledge and experience or are put to the full expense of making the plans and specifications and supervising the installation of the engineering equipment? The engineer certainly is put to the full expense customary in professional services of this nature, and the architect is put to a certain but not equal expense. Therefore, a logical conclusion would seem to be that the engineer should be paid a full fee and that the architect should be paid in proportion to the expense to which he is put, plus the usual profit. Thus the owner gets full value of what he pays.

An arrangement which has many times proven satisfactory provides an extra payment of 2½% to 3% for engineering services, depending upon whether the architect's fee was 5% or 6%.

The payment of an extra 3% on the mechanical equipment of a building represents apparently an increase on the cost of the building of but three-tenths to seven-tenths of 1%, but actually the employment of the independent engineer will save much more than this in the cost of installation and in the annual cost of operation and maintenance. The use of contractor's or manufacturer's plans and specifications will assuredly mean an increased cost of installation and operation much greater than the amount of the engineer's fee.

By some it is contended that the architect's fee over the entire building should be increased sufficiently to include the cost of engineering services. The first objection to this lies in the popular, but mistaken, impression that the architect's fee is already extremely profitable and, consequently, a further general increase would be most unpopular. A second objection is that some architects would still not employ the engineer while others would employ the cheapest talent. Again, in a hospital costing $1,000,000 the entire equipment might represent 25% of the cost of the building and in a cathedral costing the same sum the equipment might cost but 5%. This difficulty would

be experienced in fixing a rule or even in determining the correct fee in an individual case.

The demand for a full extra fee on the mechanical equipment has many times led owners to separate entirely the architectural and engineering work, paying to the architect and engineer a full fee on the portion of the work assigned to each only.

There is a disposition among certain engineers to argue that the construction of a building, including foundations, structural steel, walls, floors, partitions, spacing and equipment is largely an engineering problem and that, therefore, the entire commission should be placed in the hands of an engineer who should employ an architect to add the esthetic features to the plans.

The adoption of an accepted method of procedure adhered to by all architects will materially lessen the force of such views.

ENGINEERING SERVICES IN ARCHITECTS' SCHEDULE OF CHARGES AND CONTRACTS.

The lack of uniformity in the practices of architects in these matters has befogged the entire subject and prevented altogether the enlightenment of the owner.

The schedules of fees of the American Institute of Architects provides that the owner shall pay extra for engineering fees where such services are required, but to the average owner this provision is ambiguous. It does not state the amount of such extra payment nor does it state to what class of work this rule is to be applied. Consequently some architects suffer extreme embarrassment in asking for an extra payment for engineering services, while others, and I have one particularly in mind, unhesitatingly apply this rule on practically all occasions.

Recently I have had three different experiences, all of the architects involved being members of the American Institute of Architects. In the first case I had the good fortune to be personally acquainted with five of seven members of the building committee. This gave me an unusual opportunity for this presentation of the American Institute of Architects' rule for extra payment for engineering services. I still believe that this rule could have been made effective in this case had not the selected architect volunteered to assume all of the expense of engineering services. In the second instance the president of the building committee was an intimate friend and was agreeable to paying extra for engineering services. The architect in this case volunteered to relinquish all claim to a fee on the engineering equipment so that the engineer and architect were employed and paid separately. In the third case the committee had been brought to a point where they were prepared to pay extra for engineering services when three architects volunteered to assume the expense of engineering services if they but be given the job.

In the matter of payment to the engineer there is just as little uniformity of practice.

Is there any reason why the method of payment provided for in the architects' schedule of charges should not be applied by the architect in making payments to the engineer, even to the payment of the usual proportion of the engineer's fee when the letting of the contract is delayed through no fault of the engineer, especially when the making of the plans and specifications for the engineering equipment by the engineer has been essential to the letting of the construction contract, and the architect has received his usual payment of the construction contract?

Let us consider briefly a few examples of contracts or competition programs making provision for the employment of engineering services. First we will note the admirable provision in one of New York City's architectural contracts. Of course it should have provided 6% instead of 5% to the architect and 3% extra for engineering.

"As additional and cumulative compensation, and for the employment of an engineering specialist, 2½% of the total cost of the heating and ventilating work, plumbing, electrical and refrigerating work, power plant and apparatus, appliances, appurtenances, fixtures and equipment, including such fixtures, fittings, cooking appliances and the like as may be necessary and proper to render the work, building, or structure complete and ready for service and use, will be paid."

This could have been improved by stating its evident intent that the engineer be paid 5%.

From the competition program for the New York County court house:

"When and as often as the board shall determine that the employment of engineering or other specialists is necessary for the proper performance of the work, either in the preparations of the plans and specifications or in the supervision, superintendence and direction of the erection, then the architect, at his own sole cost and expense, shall employ such engineering and other specialists for the purposes aforesaid, and in every such case such engineering or other specialists must be such as the board shall, in writing, approve."

This is wrong in that the architect is not in any degree reimbursed for the cost of engineering services.

From the competition program for the Albany court house and public buildings at Wilmington, N. J.:

"The board is to reimburse the architect the cost of the services of engineers for heating, mechanical and electrical work. The employment of engineers and their compensation shall be subject to the approval of the board."

This is too indefinite, failing to specify the amount of extra compensation.

From the competition program for a library building at Indianapolis:

"The architect is to nominate a clerk of the works and the engineers for the heating, ventilating and electrical systems of the building, and their proposed compensation having been approved by the board, the architect is, by and with the consent of the board, to appoint them."

Observe, please, the variety in these provisions. Only the first provides for the rate of compensation for engineering services. The engineer has the same reason as has the architect to desire his fee to be fixed. In as much as this is a part of the architect's fee, also to the end that all uncertainties shall be eliminated from the competition program, which is usually the basis of the architect's contract, it would seem desirable that this matter should be definitely determined.

A SUGGESTION FOR RULE COVERING EXTRA PAYMENTS FOR ENGINEERING SERVICES.

The first essential in the solution of this problem is an agreement upon some acceptable rule, the second essential is a strict adherence thereto, and the third, and perhaps the most important essential, is the enlightenment of the owner and building committees.

May I make so bold as to offer the following suggestion for a rule covering this matter?

"In connection with the heating, ventilating, plumbing, electrical, refrigerating, elevator, cooking, laundry, power plant and other mechanical equipment, the architect shall employ consulting engineers who shall, in co-operation with the architects, design, prepare plans and specifications for, and supervise the installation of the above equipment. The engineers so selected shall be subject to the approval of the owner, the rate of compensation to be paid by the architect to the engineers to be 6%, the owner hereby agreeing to pay to the architect 3% additional on that portion of the work upon which engineering services are employed. The architect shall at all times be chief in authority."

The Performance and Selection of Centrifugal Fans

DATA AND NOTES APPLYING TO BOTH STEEL PLATE AND MULTIVANE TYPES.

BY THE LATE FRANK L. BUSEY.

(*From a Paper Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January 20-22, 1915.*)

Frequent reference has been made in fan work to *static pressure* and *velocity pressure,* and also the conversion from velocity to static pressure at the fan outlet. The air is delivered against a certain definite resistance of the system, due for instance to ducts and heaters, and this is termed static resistance. It is then necessary for the fan to develop a definite static pressure sufficient to overcome this resistance of the system. In addition to the *static* pressure, the air has imparted to it a certain *velocity* pressure due to its velocity on leaving the fan outlet, this velocity being dependent on the amount of air handled and on the area of the outlet.

The total energy imparted to the air is composed of the static pressure of the system and the energy of discharge corresponding to the velocity pressure, or velocity head as it is termed in hydraulics. *The total pressure is the sum of the velocity pressure at the fan outlet and the static pressure of the system,* and is the pressure upon which the performance and efficiency of the fan is usually based. In the case of an exhaust or draw through system, the static head on the fan should be taken as the difference in static pressure at the inlet and outlet of the fan, one being positive and the other negative.

DEFINITION OF STATIC AND VELOCITY PRESSURES.

The relation between static and total pressure and between static and total efficiency in fan work is not generally understood. Many engineers as well as fan builders consider only the total efficiency of a fan, even when the resistances are estimated in static pressures. The static pressure is the potential energy developed by the fan, and is the energy available for performing useful work in overcoming the frictional resistance of the system. The velocity pressure is the kinetic energy used in moving the air and is a measure of the air quantity handled, but until it is converted to static pressure is not available for overcoming resistance.

Thus it is seen that the greater the static pressure developed at the fan outlet in proportion to the velocity pressure, the more effective will be the performance of the fan in overcoming frictional resistance, and therefore the greater the *static efficiency.* Since the velocity and therefore the velocity pressure varies inversely as the area of the fan outlet, and since the sum of the static and velocity pressures are constant (being equal to the total pressure), it is evident that the larger the outlet of a fan the greater will be the static pressure developed.

FAN EFFICIENCY.

The efficiency of a fan is the ratio of the power output to the power input, or the ratio of the work done in delivering a certain amount of air against some known pressure to the work done by the engine or motor used in driving the fan. We may have two different efficiencies, either *static efficiency* or *total efficiency,* depending on whether we are considering static or total pressure. Since the total pressure is greater than the static pressure, the total efficiency is greater than the static efficiency, and for this reason the efficiency generally referred to in fan performance is based on the total pressure.

It has been seen that a high static pressure and a correspondingly high static efficiency are of vital importance in fan performance. A fan having a high total but a low static efficiency may in most cases be less desirable than another having a high static efficiency, even though the total efficiency be less than that of the first fan. Since in the majority of installations the principal work performed by the fan is in overcoming the static resistance of the system, a fan giving a high static efficiency means a

low power consumption, and at least where power is being bought it means a saving in dollars and cents.

HOW TO DETERMINE STATIC EFFICIENCY.

Although but few fan builders are accustomed to mention the static efficiency of their product, the static efficiency may be readily calculated when the ratio of static to total pressure at rated capacity of any special fan is known. Thus if the static pressure is 80 per cent. of the rated total pressure, the static efficiency will be 80 per cent. of the total efficiency. Or expressed as formulæ, the efficiencies are:

$$\text{Static eff.} = \frac{0.0001565 \times Q \times \text{static press. in inches}}{\text{H.P.}}$$

$$\text{Total eff.} = \frac{0.0001565 \times Q \times \text{total press. in inches}}{\text{H.P.}}$$

where Q equals the quantity of air in cubic feet per minute, the pressure is expressed in inches of water, and H.P. represents the horse power input.

Thus it is seen that the ratio of static to velocity pressure at the fan outlet is of the greatest importance in fan selection. This ratio varies as the square of the fan capacity, at constant speed, and bears a definite experimental relationship to the efficiency of the fan.

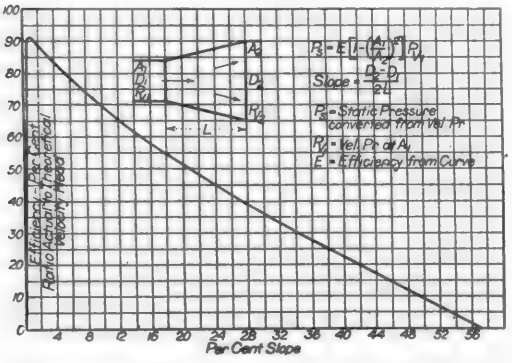


FIG. 1—EFFICIENCY OF DIVERGING NOZZLES.

As already mentioned, where the velocity and consequent velocity pressure at the fan outlet is very high, a part of this velocity pressure may be converted to static pressure and the desired ratio between the two obtained, by using a diverging cone or chimney outlet on the discharge of the fan. The efficiency of this conversion depends on the slope of the sides of the cone, and is never the full 100 per cent. That is, there is always some loss of head in converting from velocity to static pressure.

As will be noted from a study of Fig. 1, a diverging cone or nozzle, to give the maximum conversion from velocity to static pressure with the least possible loss, must be constructed with an easy slope and not with an abrupt flare. The diagram here shown indicates what may

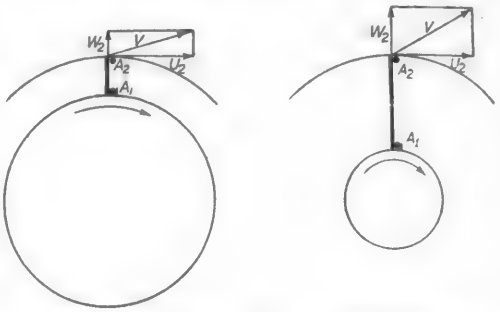


FIG. 2—EFFECT OF CENTRIFUGAL ACTION IN FAN WHEELS.

be termed the efficiency of diverging nozzles having different slopes to the sides. We note that with a 10 per cent. slope, or a slope to each side of say one inch in ten, the efficiency of conversion is 70 per cent. That is, while there will be a certain drop in velocity pressure due to the enlargement in cross-section of the pipe, only 70 per cent. of this drop will be converted to static pressure in the cone and the balance will be lost. While as high as 90 per cent. conversion may be obtained, the cone would have to be longer than is generally found practical and a cone with 10 per cent. slope gives good average results. If made with a length of twice the smaller diameter, and the area of the large end twice that of the small end, a diverging nozzle will have a slope of approximately 10 per cent.

RELATIVE PERFORMANCE OF THE STRAIGHT AND CURVED BLADES AND OF THE STEEL PLATE AND MULTIVANE TYPES OF FANS

In any centrifugal fan there are two separate and independent sources of pressure. First, pure centrifugal force

due to the rotation of an enclosed column of air. Second, the kinetic energy contained in the air by virtue of its velocity upon leaving the periphery of the fan rotor. The amount of centrifugal force imparted to the air depends largely upon the ratio of the tangential or rotational velocity of the air leaving the periphery of the rotor to the tangential or rotational velocity of the air entering the fan at the heel of the blades.

The effect of the centrifugal force of the column of air between the blades of a fan is frequently overlooked, since it is difficult to think of the air as having weight. The action of the particles of air within the fan wheel may be illustrated by the two diagrams in Fig. 2. If we consider a particle of air located at A_1 at the heel of the blade, when the wheel is rotated this particle will be thrown to the tip of the blade, and the centrifugal force will give it a certain velocity W_2. But at the same time, the particle has imparted to it a certain rotational or tangential velocity U_2. The resulting velocity V represents the force actually imparted to the particle of air as it leaves the tip of the blade. A comparison of the two figures will show why a fan with longer blades—if they are both straight—will give a greater pressure than will a short blade fan at the same speed. That is, the pressure for a given peripheral speed is increased by increasing the relative length of the blades.

The method used for overcoming this fault of the short straight blade is to make it curved. The effect of so doing is shown by the diagram Fig. 3, the effect on the velocity by curving the blades forward or backward being indicated by the parallelograms. It will be noticed that when the blade is bent forward, a pressure greater than that corresponding to the peripheral velocity is obtained. This results in the same pressure with a lower speed than would be necessary with the straight blade when using the same wheel diameter. On the other hand it is sometimes desired to direct-connect the fan to a high speed unit without developing the corresponding high pressure. This is accomplished by bending the blades backward, so obtaining a pressure less than that corresponding to the peripheral velocity.

TWO CLASSES OF CENTRIFUGAL FANS

Centrifugal fans may be roughly divided into two classes, fans having rotors with straight radial blades, and fans having rotors with blades curved with reference to their direction of rotation. Curved blade fans have quite diverse characteristics depending on whether they are curved forward or backward with reference to their direction of rotation. The mathematical theory of the radial blade fan is very completely and clearly discussed in Prof. Carpenter's book on Heating and Ventilation. The amount of total pressure developed by a straight blade fan may be

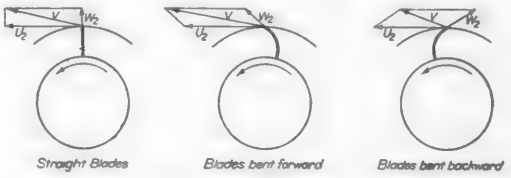


FIG. 3—RELATIVE EFFECT OF DIFFERENT SHAPED BLADES.

mathematically determined, but in the case of a curved blade fan this can only be known by means of actual tests.

The amount of pressure developed by a straight blade fan may be determined by means of the formulæ.

$$P_s=\left(\frac{U_2}{V_0}\right)^2\left[e+(1-R^2)-f\left(\frac{V_1}{U_2}\right)^2\right]-\left(\frac{V_2}{V_0}\right)^2$$

$$P_v=\left(\frac{V^2}{V_0}\right)^2$$

Where P_s = static presure at fan outlet.
P_v = velocity pressure at fan outlet.
V_0 = velocity corresponding to unit pressure.
V_1 = velocity of air entering fan inlet.
V_2 = velocity of air at fan outlet.
U_2 = peripheral velocity of wheel.
R = ratio inlet to wheel diam.

e and f are coefficients varying with the ratio of height to width of fan outlet.

When the flow of air through the rotor of a fan is partially obstructed the centrifugal effect in the rotor produces a compression corresponding to the centrifugal force, which is known as a static pressure. On the other hand, the kinetic energy of the air leaving the periphery of the rotor must first be converted largely into potential energy in the form of static pressure before being serviceable. This conversion from kinetic energy or velocity into potential energy or static pressure is ordinarily accomplished in the scroll formation of the fan housing. A still further conversion is often secured, where the velocity leaving the outlet is high, by means of a diverging nozzle on the outlet of the fan.

The velocity of the air leaving the tip of the blades and the corresponding velocity pressure is greatly in excess of that ordinarily required in the piping system, and at the same time the static pressure is too low. By enclosing the wheel in casing having a properly designed scroll, this velocity is reduced and a part of the velocity pressure is converted to static pressure. Since the static pressure due to the wheel will vary as the difference of the squares of the rotational velocities at the periphery and inlet, it is evident that the shorter the blade the greater must be the dependence on the scroll shaped housing to obtain the desired static pressure. For this reason the proper design of the housing is of greater importance in the case of a short blade multivane type of fan than with the older styles.

HOW STRAIGHT BLADE FANS MAY BE MADE MORE EFFICIENT THAN MULTIVANE FANS

The standard steel plate fan is essentially a straight blade fan, as compared with the later styles of short curved blade multivane type, although, as already shown, when the tip of the blades are bent either forward or backward the fan will have different characteristics from one with strictly straight blades. This fan as ordinarily built does not give as high an efficiency as the multivane type, owing to the fact that it is designed for large capacity rather than for high efficiency. But if these long blade fans are built according to special design they may be made to give greater efficiency than can be obtained from the curved short blade fans. This calls for a tall narrow fan with the inlet diameter smaller than that used on the standard fan. It may be readily shown that there is a certain diameter of inlet that will give maximum economy of operation. If the diameter is increased the loss by impact at the heel of the blades is increased as the square of the diameter, and the loss by entrance is decreased as the fourth power of the diameter. The opposite holds true in case the inlet diameter is decreased.

The proper size of the fan inlet depends on the cubic feet of air per revolution handled by the fan. It has been determined both mathematically and

TABLE I. — COMPARATIVE EFFECT OF BLAST WHEEL PROPORTIONS UPON THE EFFECT OF STRAIGHT BLADE FANS OPERATING AT THE SAME CAPACITY AND PRESSURE.

Ratio of Dia. Inlet to Dia. Wheel at Perip.	Per Cent. Relative Diameter. Wheel.	Inlet.	Per Cent. Relative Width.	Per Cent. Relative H.P.	Per Cent. Relative Speed.
0.700	82.0	91.9	108.9	112.3	123.0
0.650	93.2	97.5	102.5	104.0	109.5
0.625	100.0	100.0	100.0	100.0	100.0
0.600	106.9	102.6	97.5	96.7	92.7
0.550	123.5	108.8	92.1	91.0	78.2
0.500	144.9	116.6	85.9	86.8	64.5
0.450	170.8	123.0	81.3	83.4	53.3
0.400	206.5	132.4	75.5	80.0	43.1
0.350	255.0	142.8	70.1	77.5	34.6

experimentally that the most efficient diameter of inlet is given by the equation

$$D_1 = C\sqrt[3]{\frac{Q}{N}}$$

Where D_1 = inlet diameter.
Q = cu. ft. air per minute.
N = revolution per minute.

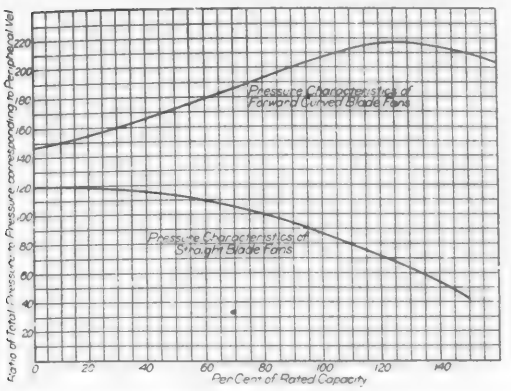

Ratio of Total Pressure to Pressure corresponding to Peripheral Vel
Pressure Characteristics of Forward Curved Blade Fans
Pressure Characteristics of Straight Blade Fans
Per Cent of Rated Capacity

FIG. 4—PRESSURE CHARACTERISTICS AT CONSTANT SPEED.

C = is a factor determined experimentally and is practically a constant for all ratios of inlet diameter to wheel diameter.

It may be noted from Table I that the essential factor in the design of straight blade fans is the diameter of the inlet, and that the smaller the inlet as compared to the diameter of the wheel, the greater will be the efficiency attained, but at a sacrifice in capacity. This table is based on the assumption that a value of 62.5 per cent. for the above ratio be used to represent the average standard fan, and the other figures show the comparative values for other ratios. It will be seen from the second and fourth columns that the height of the fan increases rapidly while the width decreases. This means, then, that these special high efficiency fans are tall and narrow, which naturally makes them more expensive than the ordinary commercial steel plate fan.

These special tall narrow fans are frequently used for induced draft work, partly because the narrow wheel makes a shorter overhang on the fan bearing, and partly because they may be operated at lower speed and are therefore more suitable for direct connection to steam engines.

It will be noted from the diagram Fig. 4, that the pressure characteristics of the fan with forward curved blades are quite different from those of a fan having straight blades. Although this peculiarity of the two types is often overlooked and perhaps not generally understood, it is nevertheless of the greatest importance and should be considered in the selection of a fan. We see that with a straight blade fan the pressure tends to build up as the load on the fan is reduced, while operating at constant speed.

Thus, if such a fan be used to supply forced draft to a boiler, and due to the thickening of the fuel bed the discharge from the fan should be throttled, the pressure will increase. This is just exactly the condition that would be desired. On the other hand, with a forward curved blade, as the air delivery is decreased the pressure would also fall off. Another case where this peculiarity

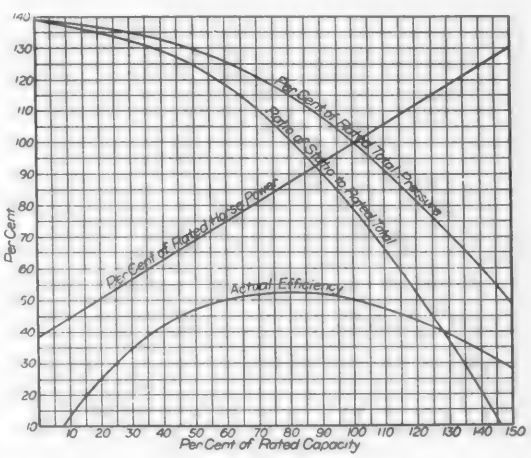

Per Cent of Rated Total Pressure
Ratio of Static to Rated Total
Per Cent of Rated Horse Power
Actual Efficiency
Per Cent
Per Cent of Rated Capacity

FIG. 5—PERFORMANCE CURVE OF BUFFALO PLANOIDAL STEEL PLATE BLOWERS, STRAIGHT BLADE TYPE.

is of importance is when a fan is required to operate part of the time at a considerable underload, yet a definite pressure must be maintained. For such a case the straight blade fan should be used.

The general characteristics of the

two types of fans will be shown by Figs. 5, 6 and 7. The most noticeable difference between the two is in the pressure curves and the horsepower curves. Here we have shown the characteristics of a typical straight blade fan, in which the pressure increases as the load is decreased. It will be noted in this case that the H.P. characteristics gave a straight line, this being a peculiarity of the straight blade fan.

Fig. 7 shows the actual test results obtained from a fan with forward curved blades. In making a shop or laboratory test the most accurate results are obtained by attaching to the fan outlet a straight pipe of about thirty diameters in length, with means provided at the discharge end of attaching plates having different sizes of openings. In this way, the quantity of air handled may be

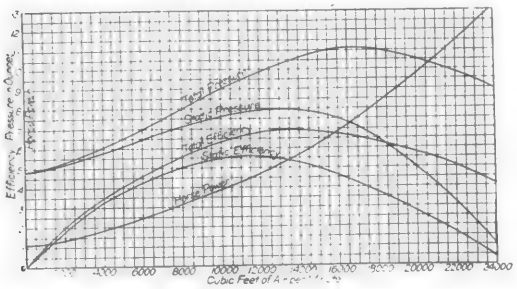


FIG. 6—TEST OF A NO. 8 NIAGARA CONOIDAL FAN. 450 R.P.M.

varied from nothing to the full capacity of the fan, and by this means the performance of the fan at different capacities may be determined. The fan is then operated at some constant speed, and by means of a Pitot tube in the discharge pipe about twenty diameters from the fan outlet the pressures developed with each outlet are noted. At the same time power readings are taken in order to compute the horsepower and efficiency.

These values are then plotted and curves drawn as in Fig. 6, and by a study of these curves a certain capacity is selected as giving for the widest range of conditions the most satisfactory performance characteristics for this type of fan. This point is then termed the rating of this size of fan at the speed used. By redrawing these curves as shown in Fig. 7, in per cent. of the rated performance, the characteristics

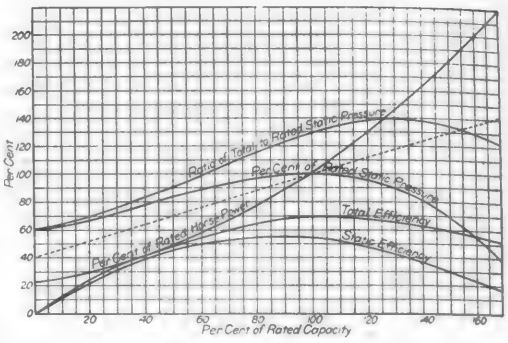

Per Cent
Ratio of Total to Rated Static Pressure
Per Cent of Rated Static Pressure
Total Efficiency
Static Efficiency
Per Cent of Rated Horse Power
Per Cent of Rated Capacity

FIG. 7—PERFORMANCE CURVE OF BUFFALO NIAGARA CONOIDAL FAN, FORWARD CURVED BLADE TYPE.

of this style of fan for any size may be readily found for any other than the rated capacity. The ordinary fan capacity tables are evolved from the values selected at point of rating.

It will be seen from this diagram, Fig. 7, that the pressure curves for a fan with forward curved blades are entirely different from the ones already shown in Fig. 5 for the straight blade type. At no load the total pressure is 47 per cent. of the rated, while with the straight blade fan the ratio is 140 per cent. The dotted line is the H.P. curve reproduced from the diagram of a straight blade fan. The most important point to be noted here is the great difference btween these two lines beyond the point of 100 per cent. capacity. We see how rapidly the horsepower goes up with an overload, with the total pressure also increasing. This explains why any fan

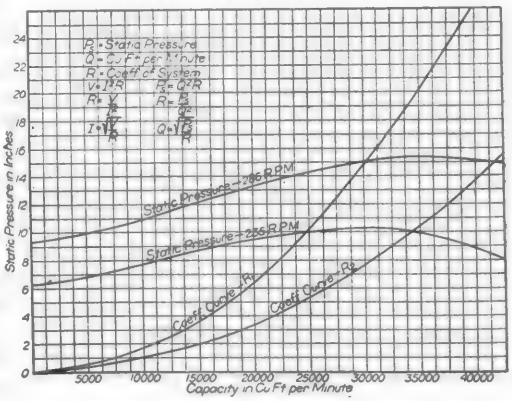


FIG. 8—RELATIVE PERFORMANCE OF A NO. 10 NIAGARA CONOIDAL FAN.

with short forward curved blades is so liable to overload the motor, if by any chance the static resistance of the system should happen to be less than estimated. For instance, if a fan should draw its supply of air through the by-pass during the summer, instead of through the heater, as ordinarily designed, the resistance of the system may be decreased sufficiently to increase the quantity of air handled as much as 15 per cent. The increase in power consumption for a straight blade fan would be about 8 per cent., but with a forward curved blade such as here considered the increase in power would be about 19 per cent.

The concluding portion of Mr. Busey's paper, which is devoted to fan selection, including an explanation of the new fan tables, giving the fan performance at other than its rated point, will be presented next month.

District Heating

By S. Morgan Bushnell and Fred B. Orr.

CONDENSATION METERS.

This series of articles commenced in the January, 1915, issue.)

The idea of measuring the condensation from heating systems to determine the steam consumption was a very radical departure from previous practice, and did not take concrete form until 1904 in which year a patent was granted to John D. Walsh on the device which has since been manufactured under the trade name —Simplex condensation meter. The introduction of this meter marked an important step in the evolution of the industry and while it cannot be said to have been a cure-all for the weaknesses apparent in the operation of district heating systems, yet the decade intervening since the idea first took root has furnished ample justification for the experiment.

The advent of the condensation meter ushered in an era of prosperity for many heating companies that had been struggling along in hopeless financial difficulties, not because of improper installations, and management, but as a result of the inability to sell their product scientifically and secure adequate returns on the investment.

The first manufacturer to enter the field with a condensation meter was the American District Steam Company. Through its affiliations with extensive heating interests throughout the country this company in the capacity of engineers, operators and owners has been naturally equipped for taking the leadership when improvements of any kind are demanded. It is not at all strange that their experience prompted them to experiment on some device which would be more satisfactory as between company and consumer than was the primitive Holly steam meter; and at the same time offer an avenue of escape from the evils lurking in the various systems of flat rates.

Since it has been seen that steam meters are usually complicated, it follows that they will also be comparatively costly. It is obvious that for large companies serving hundreds of customers, the investment charges for steam meters would be enormous. Not only the first cost but also the amount of attention required and the labor of computing the meter records are factors entering into the question. For the multitude of small individual consumers, such as residences, stores and restaurants, the steam meter must be waived in favor of a much simpler method of measurement. The condensation meter has played a very important part in the steam heating industry, much more so, in fact, than the steam meter, primarily on account of the difference in cost. The condensation meter fills the requirements for a simple, accurate and inexpensive method of selling steam and, consequently, has been used almost exclusively by most companies, except in the largest cities.

Most of the present types of meters are acceptable for the purpose intended, provided every precaution is taken to install them properly. The most essential point to consider is the fact that condensation meters are not guaranteed to operate under pressure. They are essentially gravity meters in that they will not dis-

TABLE III.—CLASSIFICATION OF CONDENSATION METERS.

	Primary Element.	Secondary Element.	Name and Maker.	
Weight meters....	Dump bucket.	Gears and dials.	Simplex— American District Steam Co. Crescent— W. H. Pearce & Co.	1904
Volume meters....	Revolving drum.	Gears and dials.	Tyler— Tyler Underground Heating Systems.	1914
	Revolving drum.	Gears and dial.	Detroit— Central Station Steam Co.	1906
Trap meters.....	Tilt trap.	Trip counter.	Cranetilt— Crane Co.	
	Float trap.	Diaphragm counter and dial.	Trapand — J. C. Hornung.	1912

charge when there is any back pressure on the outlet or discharge line. Therefore, their use is limited to places where the following can be observed:

LIMITATIONS IN USE OF CONDENSATION METERS.

1. The returns from the radiation must pass through a steam trap of the constant or continuous flow type, to prevent sudden surges of the return water. This liability is present when pot or bucket traps are used.

2. Some method must be adopted for relieving the discharge line from the trap of any vapor which might otherwise enter the meter. Hot water vapor or air, in mixture with the condensation, has a tendency to "spin" the revolving type meter; and, due to its pressure, produces a velocity of impact on the dump type. Both of these effects lead to inaccuracy, usually over-registering. Methods of overcoming this are shown in Fig. 1.

3. The meter must have a free and unobstructed discharge to a suitable catch basin if the returns are to be wasted to the sewer, or connected to a return line, which must be under gravity or vacuum pressure.

Fig. 2 shows the Simplex condensation meter which is of the "dumping type." This meter will be found to be reasonably accurate between temperatures of 55° F. and 180° F.

The Detroit condensation meter, first put on the market about 1906, is shown in Fig. 3. Since then many of the defects present in the original designs have been eliminated successfully. The patent covering the application of the revolving drum or turbine to the measurement of fluids was issued to Hans Reisert, of Cologne, Germany, and the rights were acquired by the present manufacturers in 1907. Among several improvements added to the original instrument is one adapting the meter to vacuum return lines which is accomplished by making

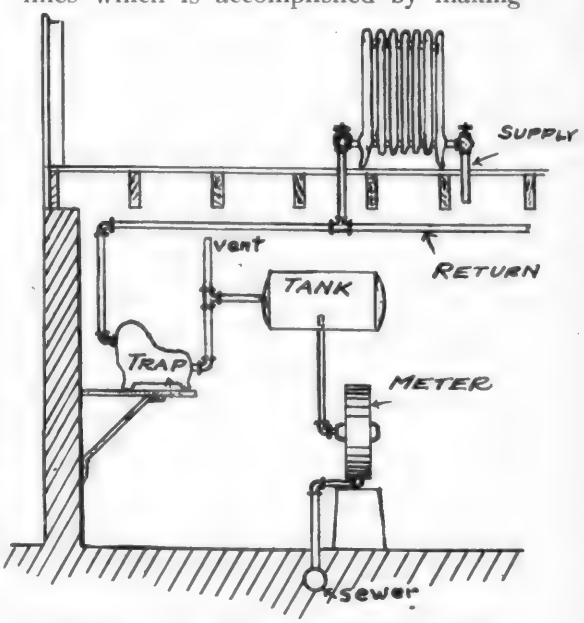


FIG. 1—METHOD OF CONNECTING CONDENSATION METERS TO PREVENT "SPINNING."

an air-tight drum casing. A suitable vacuum pot or trap must be connected ahead of the meter to prevent leakage of steam into same.

This feature does away with one of the principal difficulties in the way of a general adoption of condensation meters,

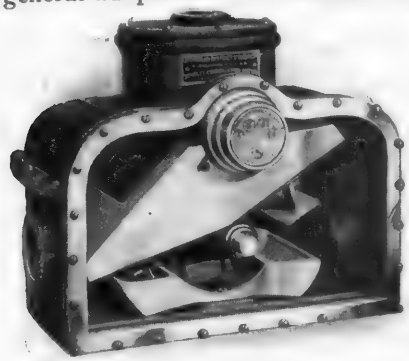


FIG. 2—VIEW SHOWING CONSTRUCTION OF SIMPLEX CONDENSATION METER.

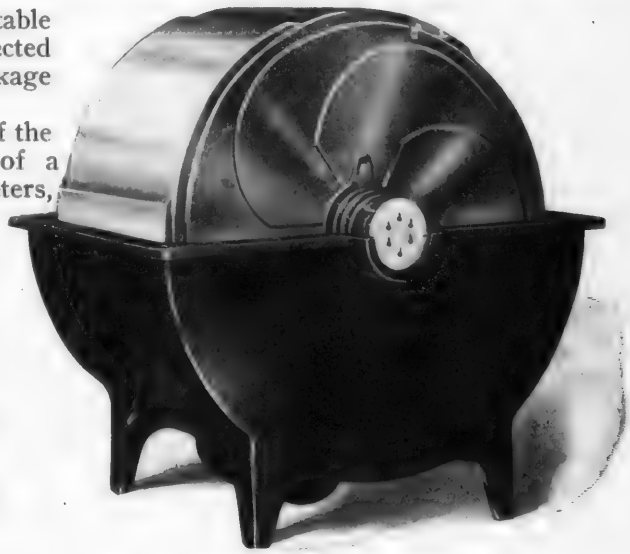


FIG. 3—DETROIT CONDENSATION METER WITH COVER REMOVED.

viz.: adaptability to vacuum systems of heating, thus obviating the necessity of wasting the returns.

CARE AND MAINTENANCE OF METERS.

If a steam heating business is to be conducted successfully, every reasonable effort must be made to preserve cordial relations between company and consumer; and the surest method of accomplishing this is to show a desire on the part of the former to maintain the metering apparatus in first-class condition. As may be inferred from the preceding discussion, if meters are to be depended upon for accuracy and reliability, much greater vigilance will be required than is the case with electric meters. This requires a thorough inspection service, combined with close scrutiny of the records of steam consumption to determine if the meter is operating satisfactorily. The causes of faulty registration may be most conveniently grouped under the following heads:

GROUP I.—METER DEFECTS.

Area Meters.—Meters may be too large for the average load.
Valve may stick or bind due to foreign matter in steam.
Orifice may become enlarged if valve pounds on seat.
Clocks and recording mechanism may be out of order on account of heat, vibration or other causes.
Pencil arm may be loose on shaft.
Meter out of vertical alignment.

Velocity meters.—Pitot-tube may be twisted out of position in the pipe.
Pitot-tube may become partially clogged by foreign particles in steam.
Leaks in piping from tubes to manometer.
Loss of mercury due to leaks.
Loose wiring connections to recording instruments.
Faulty voltage regulation for recording instruments.

Condensation meters.—Meter too small or improperly installed.
Tight bearings—need of lubrication.
Oil or other foreign matter in drums or buckets.
Spinning or sticking of drums or buckets.
Meters out of level.
Tampering by consumer.
Nozzle or spout obstructed.
Moving parts out of their proper bearings.
Register trouble—dial hands and gears loose, pinions bent, etc.

GROUP II.—SYSTEM TROUBLES.

Installation.—Vapor vents to relieve excess pressure.
Leaks in steam piping.
Leaks in return piping.
No protection against surging or flooding.
Wrong type of steam trap.
For vacuum meters a vacuum pot or trap is necessary.
Not sufficient fall to the sewer.
Not sufficient head on the inlet to secure full capacity of meter.
Sediment trap should be provided.

Operation.—Defective and leaky steam traps.
Sewer clogged up.
Condensation diverted, intentionally or otherwise.
Flooding of meter in early morning, due to returns being held up during the night.
Sediment trap filled.
Chemicals in return water may corrode parts of meter.
Temperature too high.

A study of the above emphasizes the great importance of this phase of the subject but unfortunately lack of space will not permit of a complete discussion of the points referred to. The literature to be procured from the manufacturers will call attention to the care necessary for successful operation of each individual meter, but the reader is urged to consult the "Transactions of the National District Heating Association," 1912-13-14, in which volumes a large fund of valuable data is to be found. These data have been prepared by committees apointed by the Association, and their reports, together with the discussions of same form the most authentic account of the experiences of many steam heating companies. A digest of these reports brings out the following important points:

Meters should be read as often as practicable in order that any defect may be immediately noted and rectified. It is not sufficient to follow the policy of the electric companies, where meters are read monthly. Much more attention is necessary.

Meters should be tested at least once each year and oftener, if erratic records have been obtained.

Much of the trouble is wrongly charged to meters since it may be the result of defects with the system of piping.

Where meters are not used in the summer season they should be protected against corrosion by being properly drained and painted.

Meters are more liable to under-register than otherwise, therefore the expense of maintaining them in good condition is in the interest of the company no less than the consumer.

GENERAL CONCLUSIONS.

It might be thought within the scope of this article to differentiate more closely as to the relative accuracy, and reliability of the different meters which have been described, but in view of the fact that the actual development of the leading makes of meters, has covered only a very few years and practically all of them are now undergoing refinement in various degrees, it is obviously unfair to

pronounce final judgment upon the question.

In general those manufacturers who recognize the paramount necessity of calibration are most likely to produce a device which can be relied upon to fill the requirements. Calibration is the key note of the art; and although we have covered at some length the theoretical principles involved and found that the various formulas could be applied with fair approximation to practical results, yet commercial requirements demand some assurance that the instrument will have been thoroughly tested under somewhat similar conditions to those for which it is to be used. A considerable part of the cost of steam flow meters is due to the expense of calibration but from this there is no escape. With this done, the steam meter may be considered as an instrument of convenience and practical utility, although in the present state of development it perhaps lacks many of the elements necessary for universal adoption.

There are few, if any, decisions which prescribe the maximum allowable error for steam companies in their dealings with the public. After considering all the facts, it would seem that commercial steam service should be supplied on the basis of an allowable variation of from 5% to 7% from the actual consumption. In other words, the companies should not be under strict legal requirements to adjust bills, unless the error has been established as lying beyond this limit, although the calibration constant of the meter should be immediately corrected according to the test results. This practice would agree with that adopted by many electric companies, although the limit of error is somewhat lower, generally 4%, which is to be expected on account of the greater ease of measuring electricity.

With reference to condensation meters, it has been seen that it requires only attention to the details of installation to procure uniform results and place these devices on a par with electric meters, as regards simplicity and precision. When choosing between the different meters now on the market it is well to rely upon the evidence to be procured from those steam companies which have experimented upon all the various types. The selection of a meter should be governed by its general reliability and expense of maintenance; as well as upon its accuracy and initial cost.

The drawback connected with condensation meters is the possibility of not receiving all the returns from the system. These may be diverted in many ways by unscrupulous customers, or through leaky piping which often escapes inspection. Frequently, it is necessary to supply steam for open jets in restaurants and industrial plants and it is impossible of course to meter the steam used for these purposes by the condensation method. Nor can these meters be used where any steam pumps are operated, unless some method is adopted of condensing all the exhaust steam. Thus it is seen that the utility of this type of device is confined within certain limits which prevent its universal adoption as a substitute for the steam meter, although it will probably never be supplanted for small consumers of steam.

The ideal meter, perhaps, is one which will measure the rate of flow of steam as it enters the consumers premises and will automatically integrate the quantity in a way similar to that which prevails in the measurement of other domestic utilities—gas, water and electricity. Such a device should be very simple in construction so as to keep the cost within reasonable limits and confine the number of parts to a minimum. The recording feature should be retained, as it furnishes indisputable evidence in case bills are questioned. It is of course, desirable that the fluctuations in pressure be compensated by some simple method. If these points were incorporated into an instrument the scientific conduct of district heating would be an assured fact.

Attempts have been made to build satisfactory instruments for the purpose of metering the heat supplied in terms of British thermal units, instead of the prevailing custom—pounds of steam. Such a device is urgently needed by hot-water heating companies, as by this method the present compulsory use of flat rates would then be unnecessary.

Next month the authors will discuss the relation between steam and electric loads in buildings and the sale of heating service as an adjunct to central station service in large buildings.

THE HEATING AND VENTILATING MAGAZINE

Vol. 12 April, 1915 No. 4

PUBLISHED MONTHLY BY THE

Heating and Ventilating Magazine Co.

1123 BROADWAY, NEW YORK

A. S. ARMAGNAC.....*President*
GUSTAVE PETERSEN....*Secretary and Treasurer*

A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

Subscription	$1.00 per year
Canada	1.25 " "
Foreign countries	1.50 " "
Back numbers	15 cents each
Back Nos. prior to current year.	25 cents each

ONCE in a while the editor's mail contains a letter with a distinct jolt in it and this is the case with the following, taken from a recent communication:

"It is of course appreciated that your readers are, for the most part, master steam fitters and heating engineers and that your advertisers are, for the most part, manufacturers of steam and hot water heating apparatus, and that it is, therefore, directly to your interest to bring out particularly the high cost of electric heat as compared with systems using materials made by your advertisers and installed by your readers. However, the truth of the matter will appear regardless of whatever stand your journal assumes as to electric heat and my belief is that you can ill afford to take a stand against electric heating. Your readers are, and wish to become, interested in the best, regardless of your interests, and your advertisers will ultimately be the very ones to manufacture such specialties as are required in the installation of electric heating systems."

The phrase that appeals to us most in the foregoing is that "the truth of the matter will appear regardless of whatever stand your journal assumes." Our correspondent is on solid ground here and we believe his statement literally. The fact is that while the course of progress, especially in engineering matters, may be impeded for a time, experience has shown that "the truth will out." It must be admitted that many of the most cherished fallacies in connection with heating work have been a long time a-dying, such as the greater comparative value of exhaust over live steam for heating purposes, and the economy of ashes as a fuel, but gradually we are emerging to the upper levels.

However, the jolt in the letter quoted lies in the charge that we are opposing the development of electric heating. We think we understand what our correspondent means. It is that we and, by implication, the heating profession, are not ready to give to electric heating the consideration it deserves. We have been accustomed so long to look upon it as a visionary proposition from a commercial standpoint that we have been inclined to overlook its merits. This may be true enough, but the fact remains that outside of certain favored localities, the most impressive feature of electric heating is its high cost.

The point made by our correspondent regarding the bearing of the interests of the advertisers on the advertising policy of a journal is "important, if true." One of the striking advantages that may be possessed by the independent trade journal is its absolute freedom from such influences. Fortunately, this happy condition was one of our birth-rights and was never so firmly cherished as at present.

Recirculation of Air for Schools

EDITOR HEATING AND VENTILATING MAGAZINE:

In reference to an admirable article entitled, "Recirculation of Air for Schools," with accompanying tables, by Ira N. Evans, which you published in THE HEATING AND VENTILATING MAGAZINE for June, 1914, I wish to advise that the following are instances of errors in the article. These errors, when carried out through the computations, affect materially the final results as given in Table IV:

Table II, Column I, sixth line, change 24 to 21.

Table II, Column D, seventh line, change 2.5 to 0.025.

Table II, Column J, seventh line, change 35 to 37.

Table II, Column K, seventh line change 1080 to 1088.

Table II, Column P, seventh line, change 14708 to 8436.

In regard to power for operating the air washer, the efficiency is given as 46% on page 50, but figured as 50% in Table II.

Table III, top of table, right hand side, 4 grains moisture, 50° to 67° F. is given as 4165 B. T. U. This should be changed to 416.5 B. T. U.

Table III, top of table, left hand side, vapor from breath is given at 1.46 cu. ft. This is rather low. The weight of water vapor, 0.00115 lbs., is given for 67° F. This should be for 90°, the temperature of the breath. (See Sturtevant's "Heating and Ventilation," page 23.) The total B. T. U. vapor should be for 90° F., and not for 67° F.

Table III, Column O, the constant 4.02 should be 3.845, if 0.45 is used as the specific heat of water vapor.

Table III, Column S, this does not appear to state (at the top of the column) the formula as figured by the author.

Table III, Column F, seventh line, change 14708 to 25255.

How is the amount of water wasted determined as being equal to the volume of CO_2 produced? See page 52, right hand column, at bottom of page.

T. W. REYNOLDS.

New York, March, 1915.

REPLY BY IRA N. EVANS.

I wish to compliment your correspondent who discovered the error in my article, as it shows more than ordinary discernment and analytical power to follow a mathematical discussion of this length with intelligence. If more readers would go into these details with care it would do more than anything else to improve the quality of technical literature.

The author had some difficulty in resurrecting the details of his own effort after six or eight months. One of the errors noted by your correspondent is so glaring as to be easily apparent, and the fact that it has not been noted heretofore would seem to show that we do too little study and are apt to take most published results for granted, or else ignore them, if they do not coincide with our opinions.

The efficiency is taken as 46% in the heat loss and figures, but 50% was stated in the table. It will be correct if 46% is stated in the table. It matters little in practice, as the variation would be greater.

In Table II, Column I, sixth line, 24 to 21 is a proper correction, reducing Column M by 688 lbs., making a difference of 1.1 cents in the result; or the cost of moisture is $0.523 instead of $0.534.

Referring to Table II, Column D, seventh line, this is correct, as Column D is headed percentages and 0.025 is 2.5%.

In Table II, Column J, seventh line, 35 to 37 is correct, but as this figure was not used, it does not change the results.

In Table II, Columns K and P, these errors do not matter, as it will be noticed that 1080 and 3648 (Cols. K-O) are crossed out and are not used, as the air was taken from out-of-doors during this period and the total amount of moisture was required for the air in any case. The heat of the room and pupils was more than sufficient to supply losses and raise the temperature, and, therefore, was not considered. This was intentional; 14,708 should be, however, 14,710 B. T. U., which is too small a difference to consider.

Referring to Table III, top of the page, right hand side, there is a mistake here in the decimal point. This is a serious error, but does not change the conclusions. The writer, however, has followed the discussion through, making the corrections in Tables III and IV, which are reproduced herewith in corrected form. It makes the proposition of recirculating the air and using the steam, with a portion of outdoor air for cooling, the best. The impurities in the air in this case are only partially removed to the extent of the air supplied from out-of-doors.

In Table III, Column O, the correction in the constant would not amount to anything, as it is only the heat required to raise the temperature of vapor and could have been neglected.

Heat Required for Condensation of Moisture from Pupils
Water Vapor from Skin - 24 Hours 2 lbs. per Pupil
2/24 x 40 = 3.333 lbs per Hour
Vapor from Breath, 146 Cu Ft. .0011 5 lbs x 40 = .0673 lbs
.0673 lbs + 3.333 = 3.4 lbs. per Hour
Total BTU Vapor 67°F 1090 Less B.T.U Liquid 50°-18 = 1072
3.4 lbs x 1072 = 3650 BTU 275 BTU x 40 = 11000 BTU

TABLE III

4- ALL AIR RECIRCULATED - COOLING BY WATER

5-AIR PARTLY RECIRULATED - COOLING BY OUTSIDE AIR

ROOM 67° F : RELATIVE HUMIDITY 50% : DEW POINT 50° F.

.6 Cu Ft. x 40 Pupils = 24 Cu Ft. CO_2 per Hour
24 Cu Ft. Oxygen Vitiated x 5 - 120 Cu ft Air per Hour to replace this amount.
B.T.U For Heating or Cooling 1600 Cu Ft. Dry Air 50° to 67° F = 1824 x 17° = 31000 B.T.U.
4 Grains Moisture 58 to 67° F.
13.7 x 4 x (1089 BTU - 1081.4) = 416.5 "
31416.5 B.T.U.

Outside Temperature Periods Degrees F.	Hours Each Period	Proportion Heat Loss	Percentage Heat Loss	B.T.U Loss per Hour Each Period	Total B.T.U per Hour Required Each Period	Total B.T.U per Period and Season	B.T.U for Power in Excess of Heating per Hour	Total B.T.U for Power in Excess of Heating per Season	Total B.T.U for Cooling Required per Season	Cooling Effect of 1000 Cu. Ft. per Minute of Outside Air — B.T.U. per Hour: Raise in Temperature to 50 Degrees F.	Relative Humidity Entering Air	Grains Moisture per Cu Ft Entering Air	Grains to be Added per Cu Ft. Air	B.T.U. to Raise Temperature Vapor Entering Air	B.T.U. to Evaporate Moisture from Water 50° F.	B.T.U. Required for Dry Air	Total B.T.U to Raise 1000 Cu Ft. per Minute 20 to 30 Deg. F	Cu Ft. Air per Minute to Reduce Total to 50°	Percentage of Air From Outside	Percentage of Air Recirculated	Water Required to Remove CO_2 from Recirculated Air	B.T.U for Heating per Season: Last 2 Periods Table II Col Q	B.T.U for Power in Excess of Heating Air Washer	B.T.U for Power in Excess of Heating Steam for Humidity	Lbs. Water for Vapor for Outdoor Air
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
				43500 BTU x COL. D	31416.5 + COL. E	COL F x COL. B	55100 BTU - COL. F	COL. H x COL B	31416+3650 BTU x COL B		%		4 - COL M	4.02 COL K	1063 B.T.U. x 8.56 x COL. N	COL. K x 1140 B.T.U.	COL. O + COL. P + COL. Q	3.6666 / 1.3564 / 1600	COL 5 ÷ 1600	1 - COL T	24 CU FT x COL U x COL B	COL. G AND COL. Q TABLE II	COL. I AND COL. R TABLE II	43200 B.T.U - COL F x COL B COL. R TABLE II	II x COL. T - 54 x COL B COL. M TABLE
0-10°	5	62/80	77.5	33712	54128	270 640	972	4860	175 333	45°	60	.25	3.75	45	34125	51300	85470	326	204	796	96	270640			35
10-20	27	52/80	65	28275	48691	1314657	6409	173043	946 796	35°	60	.50	3.50	70	31850	39900	71820	374	234	766	496	1314657	173043		211
20-30	110	42/80	58.5	22873	43289	4761790	11811	1299210	3857315	25°	60	1.00	3.00	100	27300	28500	55900	450	281	719	1897	4761790	1299210		893
30-40	270	32/80	40.	17400	37816	10,210,320	17284	4666680	9467955	15°	50	1.25	2.75	75	25025	17100	42200		342	658	4269	10,210,320	4666680	1,453,680	3417
40-50	190	22/80	22.6	12000	32416	6159040	22684	4309960	6662635	5°	50	1.75	2.25	35	20473	5700	26208		466	544	2480	6159040	4309960	2,048,960	2040
50-60	232	12/80	15	6525	28941	6750,312	28159	6532588	8,135428													9207848	3575350	814,552	4880
60-70	400	2/80	2.5	1080	14708	5883200	40392	16156,800	——													5883200	16,156,800	11369800	5600
TOTAL	1234					34,849,959		33142,441	29,245462												9236	37807,495	30,185903	15686992	17076

All Air Recirculated - Cooling By Water with Air Washer
Heating Fuel 34849959 BTU / 9 x 2000 x 970 BTU = 1996 Tons Coal @ $4 - $7.984
Excess Fuel Power 33142441 BTU / 9 x 2000 x 970 BTU = 19 Tons Coal @ $4 - $7.60
Water for Cooling 29245462 BTU / 10 x 625 lbs x 1000 = 468 M Cu Ft @ $1 - $46.80
Power without Air Washer 7404 K.W.H @ 5¢ $37.02
" with " " 944 K.W.H @ 5¢ $47.20

Air Partially Recirculated Cooling by Outside Air
Heating Fuel 37807,495 BTU / 9 x 2000 x 970 BTU = 2165 Tons Coal @ $4 - $8.66
Excess Fuel Power, Air Washer 30,185,903 BTU / 9 x 2000 lbs x 970 BTU = 173 Tons Coal @ $4 - $6.92
Water Wasted Removing CO_2 9238 Cu Ft / 1000 Cu ft = 9.24 M Cu ft @ $1 - $9.24
Using Steam for Vapor No Air Washer
Excess Fuel for Power 15,686,992 BTU / 9 x 2000 x 970 B.T.U. = 9 Tons Coal @ $4 $3.60
Water for Vapor 1076 lbs / 625 x 1000 = .273 M. Cu ft @ $1 $.273

CORRECTED FORM OF TABLE III.

Regarding Table III, Column S, your critic is correct in regard to the formula, which is not completely stated. The heat required to raise 1,600 cu. ft. of air per minute, with moisture, from 50° to 67° is given as $(31416.5 + 3650) = 35066$. This involves the error of the decimal point. Column R is for 1,000 ft. per minute and 1,000 should be stated in the formula. If we required a mixture at 50°, with the initial temperature at 67°, we would have to add

$$\frac{35066}{1600} + \frac{\text{Col. R}}{1000}\ ,$$

divided into 35066, and this would give the air displaced in cubic feet, allowing for the cooling effect of the outside air and the reduction in heat, due to displacing the air.

Referring to Table III, Column F, seventh line, this should be the same as Table II. Outdoor air is used entirely and only the heat to evaporate the moisture will be required. The heat from the pupils cannot be used to evaporate the water when not recirculating air, as it has to be done in the fan room before the air enters the class room.

Chas. H. Hughes, 82 Beaver Street, New York, naval architect and marine engineer, is compiling a handbook containing practical data on ship design and construction for shipping men. He writes that catalogues and other literature on heating and ventilating apparatus, suitable for marine purposes, would be appreciated from the readers of THE HEATING AND VENTILATING MAGAZINE.

Horizontal Air Currents in Ventilation.

The proper distribution and circulation of air in a room constitutes what I regard as the real problem that the ventilating engineer has to solve, if solved it can be. It is certain that, if we are called on to ventilate a room in such a way that every individual is conscious of even a slight horizontal circulation of the air, many of our preconceived notions in this direction must fall to the ground. To begin with, as Mr. Barker pointed out in his lecture, to produce such a circulation the whole cross-sectional area of the room should be taken as the basis of circulation of the volume of air to be supplied, and the resulting figures are sufficient to indicate that such a proposition, although no doubt, under certain conditions, quite feasible, is, to all intents and purposes, outside the range of practicability, as apart from the prohibitive cost of the installation and subsequent upkeep, the introduction of such enormous volumes of air, in such a way as to secure uniformity of movement, would present great difficulties. Especially is this the case if we regard disturbing influences, such as the opening of doors and windows, the movements of the occupants and the air eddies caused by obstructions, such as furniture, or columns, galleries and other architectural features. However excellent the idea may be in the abstract, I think the figures quoted by Mr. Barker go to show that it is somewhat Utopian in character.—*H. Hearing before the Institution (British) of Heating and Ventilating Engineers.*

TABLE IV

COMPARATIVE COSTS PER CLASS ROOM

	METHOD OF OPERATION	Number of Table	Fuel for Heating	Water for Humidity and Cooling	Excess Fuel for Power over Heating	Outside Current at Power @ 5¢ per KWH	Cost of Water and Fuel for Heating Cooling	Cost of Fuel and Water for Heating Power	Cost of Outside Current Fuel Heating Cooling	Amount per Class Room for Interest and Depreciation on Isolated Plant
			A	B	C	D	E A + B	F A+B+C	G A+B+D	H G − F
1	ALL OUT DOOR AIR ROOM 70° NO HUMIDITY	I	$11.28	$——	$4.86	$37.02	$11.28	$16.14	$48.30	$32.16
2	ALL OUT DOOR AIR ROOM-67° 30% HUMIDITY-SUPPLIED BY AIR-WASHER	II	17.80	.523	4.52	47.20	18 323	22843	65.523	42.68
3	ALL OUT DOOR AIR ROOM 67° 30% HUMIDITY SUPPLIED BY STEAM VAPOR	II	17.80	.523	2.80	37.02	18.323	21 123	55343	34 22
4	RECIRCULATION TO 60° 70° OUTSIDE COOLING BY WATER USING AIR WASHER	III	789	46 80	760	47.20	5478	62 38	101 98	3960
5	PARTIAL RECIRCULATION COOLING BY OUTSIDE AIR USING AIR WASHER	III	8.66	9.24	6.92	47.20	1790	2482	65 10	40 28
6	PARTIAL RECIRCULATION COOLING BY OUTSIDE AIR HUMIDITY SUPPLIED BY STEAM	III	866	.273	360	37.02	893	12 53	4595	3342

CORRECTED FORM OF TABLE IV.

Cause of Excessive Humidity in Gas-Heated Rooms.

During the combustion of gas the hydrogen, either free or as a hydrocarbon, combines with oxygen of the air to form water. With the average manufactured gas the quantity of water thus formed amounts to about forty pounds for each thousand cubic feet of gas burned. So if the products of combustion are cooled below 212 degrees Fahrenheit, the moisture will be perceptible and even a source of much annoyance.

This may explain the humidity often noticeable in rooms where the gas-heaters are not flue-connected.

This formation of water vapor occurs whenever gas is burned regardless of the kind of burner, and precautions should be taken either to keep the products at a temperature above the condensing point or to provide means for disposing of the condensed water whenever gas is burned in such a quantity that the condensation may be an annoyance. When gas room-heaters are used as auxiliaries to other sources of heat and burned for short periods, the water vapor formed is generally not sufficient to cause annoyance.—*George S. Barrows before The American Society of Heating and Ventilating Engineers.*

Further Discussion of "Engine Condensation."

Since presenting Perry West's discussion on "Engine Condensation" in the last issue, Mr. West has contributed the following note, which is supplementary to the matter published last month. This, as well as his previous discussion, is based on the belief that there is a much too generally mistaken idea that the work of admission in a steam cylinder is done at the expense of condensation in the cylinder feed, and that the negative work during exhaust reevaporates some of the cylinder feed;

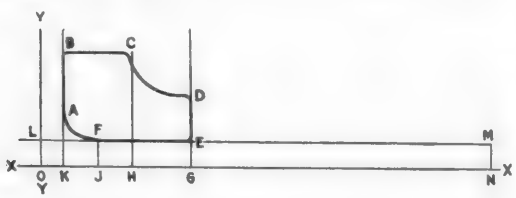


DIAGRAM ILLUSTRATING CONDENSATION OF STEAM IN ENGINE CYLINDER.

whereas, Mr. West considers that the only factors which are involved in the condensation in the cylinder feed at exhaust are the work of expansion and the work of compression.

Referring to the diagram, which is supplementary to that presented in the last issue, attention is called to the fact that in the practical condensation of this steam under a constant pressure, such as might maintain on heating systems, there are certain factors which enter, as follows: If the release pressure is above the exhaust pressure, the steam will expand along the line DEM and do work in dispelling the exhaust steam against this pressure. This, of course, takes work out of the exhaust and causes a corresponding condensation. The area LMNO will then represent the volume of steam remaining at this pressure.

Next, in order to maintain this constant pressure against the steam which is being condensed in the heating system, an amount of work must be done upon same, represented by the area FMNJ. To figure the heat available for heating under such conditions, we must, therefore, deduct the heat equivalent of the work represented by the area EMNG.

Summer Meeting to Be Held in San Francisco.

In accordance with a vote of preference on the part of the members, the summer meeting of the American Society of Heating and Ventilating Engineers will be held in San Francisco, September 16-18, 1915. These dates come just prior to the meetings of the International Engineering Congress which are to be held in San Francisco September 20-25. Already a sufficient number of members have signified their intention of going to San Francisco to assure the success of the meeting. The meeting of the International Engineering Congress, coupled with the attractions of the Panama-Pacific International Exposition, have been a potent factor in the choice of the Coast city, while the trip itself will be looked forward to as one of the most delightful features in connection with the meeting.

The railroad fare, exclusive of meals and Pullman sleeping accommodations from New York and return is $98.80, or from Chicago and return $62.50. Tickets are good for 90 days.

It is possible that a special car will be engaged for the accommodation of Eastern members.

Heating Engineers' Society to Issue Journal.

Announcement is made that the council of the society has definitely decided to publish a journal to consist largely of the papers read at the semi-annual and annual meetings. Discussions from the previous meetings will also form a part of the journal, together with reports from secretaries of chapters as to their progress and on the papers discussed at their monthly meetings. It is expected that the first number will appear in April.

Classified List of Heating Pamphlets.

A list of pamphlets on heating subjects, carefully classified, comprising papers and reports which have been presented from time to time before the heating engineers' society, has been compiled by the society and published, together with the prices at which they may be obtained. The list does not include all the papers read before the society as some are exhausted. The classification includes: Boilers for heating; car heating and ventilating; central station heating; cooling surfaces, etc.; depreciation of heating plants; drying apparatus, etc.; educational; effect of wind on heating; fans, forced blast circulation, etc.; furnace heating (hot-air); foreign practice in heating and ventilating; gas heaters; heating guarantees; heating and ventilating buildings; history; humidification; miscellaneous; proportioning steam and water pipes; radiators, transmission, etc.; steam heating; time element in heating; testing heating apparatus; uniform contracts; vapor heating, etc.; ventilation, etc.; water heating; and temperature regulation.

Copies of the circular may be had by addressing the secretary, J. J. Blackmore, 29 West 39th street, New York.

Movement for an Increased Membership.

In connection with a movement to bring to the attention of heating engineers, not now members of the American Society of Heating and Ventilating Engineers, the advantages of such membership, President D. D. Kimball has sent us the following letter which we are glad to reproduce in full:

"May I, through the columns of your paper, extend an invitation to join the American Society of Heating and Ventilating Engineers to every one of the large number of gentlemen who are eligible for membership therein but are not now members. The society is growing rapidly and its meetings and papers are of increasing interest and value. The advantages of membership are such that no one identified with the practice of heating and ventilating work can afford to lose them.

"The influence of the society is growing rapidly and a larger membership only is needed to make possible the full realization of its opportunity. Last year eighty new members joined the society. Thus far this year forty-three applications have been received and we hope to gain at least one hundred and fifty new members during the year.

"Proposal blanks may be had upon application to Mr. J. J. Blackmore, secretary of the society, 29 West 39th street, New York, or from members of the society."

New Members.

The following have been elected to membership in the American Society of Heating and Ventilating Engineers: Harry A. Austin, North Tonawanda, N. Y.; Elza B. Carr, 410 Hubbell Bldg., Des Moines, Ia.; William Coler, 116 West Center Street, Akron, Ohio; M. L. Crowell, 2077 East Fourth Street, Cleveland, Ohio; St. Gem Ebert, 1123 Broadway, New York; Claude H. Eckart, 1614 Third Avenue, Seattle, Wash.; John J. Haines, 1933 West Lake Street, Chicago, Ill.; William T. Hopson, New London, Conn.; John Howatt, 710 Tribune Bldg., Chicago, Ill.; Paul F. Johnson, care of Johnson Service Co., Milwaukee, Wis.; J. W. Johnston, 343 South Dearborn Street, Chicago, Ill.; Edwin H. Lockwood, 52 Division Street, New Haven, Conn.; G. R. McGlenn, Elmira, N. Y.; David Parkhill, 107 East 29th Street, New York; John W. Winterbottom, Lock Box 45, Station A. Waterloo, Ia.; Robert Lincoln Young, 934 St. Bernard Street, Philadelphia, Pa.; William W. Rice, 1437 North Redfield Street, Philadelphia, Pa.; W. G. R. Braemer, Camden, N. J.; D. Rait Richardson, 31 West 31st Street, New York; Ivan V. Serginsky, Petrograd, Russia.

ASSOCIATE MEMBERS.

Aaron E. Carpenter, II., 64 Dey Street, New York; Henry R. Flett, 1088 King Street, West Toronto, Ont.; John F. Siegel, 101 Park Avenue, New York; Howard I. Schulz, 626 West Pratt Street, Baltimore, Md.; H. R. Watson, 110 West 40th Street, New York; Kenneth Walter Wilson, 188 Franklin Street, Boston, Mass.; A. W. Williams, 907 Brunson Bldg., Columbus, Ohio; Frederick E. W. Beebe, 123 East 27th Street, New York.

JUNIOR MEMBERS.

F. E. Thompson, 715 Spencer Street, Logansport, Ind.; Robert J. Mayer, 1691 East 86th Street, Cleveland, Ohio; Richard A. Wolff, 222 East 41st Street, New York.

New York Chapter Hears Lecture on "Wind Leakage."

Interesting data on wind leakage were presented by F. K. Davis, of the Chamberlin Metal Weather Strip Company, at the March meeting of the New York Chapter, held at the Engineering Societies Building, March 15. The address was illustrated by lantern slides.

Previous to Mr. Davis's address a report was presented by F. K. Chew for the efficiency committee of the chapter. This report was a lengthy document and was summarized by Mr. Chew. One of the principal points was a proposition for the licensing of heating and ventilating engineers. The report also took the stand that engineering work done at a figure below 5 per cent. of the cost of the installation could not be expected to be a credit to the profession. After an extended discussion it was voted that the report be printed for the benefit of the members and also referred to the council of the heating engineers' society, to be sent out to the other chapters as a tentative code of ethics for engineers. It was further decided to make the proposed code the subject for a special meeting of the New York Chapter after the other bodies had been heard from.

F. K. Davis was then introduced and gave the chapter the benefit of his experience in connection with the study of air leakage around window sash of both wood and hollow metal construction.

"The windows of a building," said Mr. Davis, "have always been an important consideration, even before the heating engineer began to find that they were no small part of his troubles. History tells us that in mediaeval times the bakers' craft in a European city was rewarded with the right to build bay windows in the houses of its members because one of them discovered an enemy's attack in time to prevent the sacking of the city. England, when sorely in need of taxes to maintain her armies, placed a tax on windows and thereby caused the middle classes to wall up such openings, showing that not only is the window problem an ancient heritage, but that we inherit tax-dodging proclivities."

Mr. Davis said that for many years window leakage was looked upon as a necessary evil and, strange to say, no attempt was made to measure it or to accurately determine its amount for nearly fifty years after the inception of modern systems of heating.

The speaker then referred to the initial experiments made by H. W. Whitten in Baltimore in 1906 and by B. S. Harrison in New York, each working independently and without knowledge of the other's work. The next tests of importance were made by Messrs. Whitten and Collamore in Detroit in 1907.

"These tests on wood windows," said Mr. Davis, "gave the first accurate or specific determinations on window leakage under variable conditions ever made and are to-day the recognized leakage data of the engineering world."

Since then a number of tests of different scope have been made, including those on hollow metal sash which are now in progress.

Like so many other new developments, the use of metal weather strips by heating contractors to reduce heat losses from buildings was at first combated and Mr. Davis paid a warm tribute to the men who first took hold of the idea of making weather stripping an adjunct of the heating installation.

Among the tables shown by Mr. Davis was the following:

Table Showing Comparative Amounts of Air at Different Wind Velocities That Pass Through a Window Sash and Through a Corresponding Unobstructed Opening.

Wind velocity, miles per hour.	Volume of air passing through sash, cu. ft. per hour.	Volume of air passing through corresponding Unobstructed Opening, cu. ft. per hour.
10.78	15.0	33.86
15.11	24.7	46.46
21.61	37.4	67.88
26.48	47.4	82.18
30.57	57.4	95.03
34.18	65.1	107.37
37.44	73.1	117.92
40.45	80.7	126.71
43.24	88.1	136.19
45.86	95.0	144.07
48.34	101.4	151.85
55.19	124.5	173.38
73.32	149.1	194.64

Mr. Davis stated that it is a practical impossibility to heat many buildings where the air leakage is uncontrolled. While the heating engineer can, with reasonable certainty, estimate the losses from walls, floors, etc., the windows and doors are more difficult to handle because the engineer has no

control over the fitting of these and he can by no means assure himself definitely what this leakage will amount to. Competitive conditions of business would prevent him from installing sufficient radiation to meet the demand. Even in old buildings the windows will shrink and swell to a great extent so that, no matter how careful the survey, such leakage can only be assumed.

"It is not exaggerating the facts," added Mr. Davis, "to state that if the specific guarantee to heat the building to 70° F. in zero weather were in every instance rigidly enforced, 90 per cent of the trade engaged in the design and installation of heating equipment would be insolvent. I make this statement upon the basis that for more than ten years one firm alone has been called upon to weatherstrip more than 500 buildings annually that were deficient in heating equipment."

Following Mr. Davis's talk, the chapter took up the recommendation of President D. D. Kimball of the society regarding a campaign to increase the society's membership. It was voted to have a special committee for this purpose to be appointed by President Timmis. A committee was also appointed to arrange for the chapter dinner in April, when the annual election will take place. This committee is composed of W. H. Driscoll, chairman; Arthur Ritter, George W. Knight, Charles E. Scott and George G. Schmidt. The candidates, as announced last month, are: For president, W. H. Driscoll and G. W. Knight; for vice-president, Arthur Ritter and P. H. Seward; for treasurer, W. J. Olvany and C. E. Scott; for secretary, F. K. Davis and R. B. Hunt; for board of governors: G. D. Farnham, C. A. Fuller, W. F. Goodnow, H. G. Issertell, W. S. Timmis and Perry West.

Illinois Chapter Discusses Boiler Room Practice in Europe and America.

The March meeting of the Illinois Chapter, held March 8 at the Great Northern Hotel, Chicago, was devoted to a lecture by William A. Blonck, president of the W. A. Blonck Co., Chicago, on "Boiler Room Practice in Power Plants in Europe and America." The professional session followed the usual chapter dinner.

Mr. Blonck was in Germany at the outbreak of the European war and gave an interesting account of the stirring scenes in connection with the mobilization of the troops. The lantern slides which accompanied his lecture included both exterior and interior views of European power plants, a noticeable feature in many cases being the unusual height of the stacks, amounting, in some cases, to 280 feet.

The speaker paid a tribute to the progress of American boiler room practice which, he said, was in advance of anything he had seen abroad. He showed a number of instruments for increasing boiler efficiency and urged their wider use in promoting economical operation in this department.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Newark Association.

At the annual meeting of the Newark (N. J.) Association of Master Steam and Hot Water Fitters, held on March 16, the following officers were elected: President, John Nellis; vice-president, John G. Kellar; treasurer, Thomas B. Cryer; secretary, Harry Geiser; executive committee (two years), W. A. Lawson; (one year) Robert Berla.

Bill to License Master Fitters in New York State.

A bill has been introduced in the New York State Legislature which, if enacted, will compel every employing steam and hot water fitter in the State to secure a certificate of competency. For this purpose the proposed law provides for an examining board of steam fitters and general power pipe fitters, whose duties will be similar to the present Examining Board of Plumbers. Each city will have its examining board, to be appointed by the mayor and to consist of two master fitters, two journeymen who have worked at the trade for ten years, and one mechanical engineer. The salary of each member of the board is placed at $10.00 per day, but members of boards in third class cities may not draw over $10.00 per month, those in second class cities, over $20.00 per month, and those in first class cities, over $40.00 per month.

Massachusetts Bill to License Steam Fitters.

According to a bill introduced in the Massachusetts Legislature, it is proposed that all corporations, associations, firms or individuals now engaged in the steam fitting or heating business in Massachusetts must secure licenses and will not be able to employ any but licensed help. The bill is now in the hands of the Committee on Mercantile Affairs. Section 1 states that "it shall be unlawful for any person, firm, association or corporation or any agent thereof, to enter into, engage in, or perform any work pertaining to the installation of any steam, hot water, vacuum, vapor or ammonia sys-

tem, or power plants, except as hereinafter provided, unless duly licensed," etc. All persons engaged in such work will be required to first make application for examination by a State Board of Examiners, to be established in accordance with the act. This board will consist of three members, one of whom must be the State inspector of heating, power and ammonia plants, one to be an employer of three years' actual experience, and the third a journeyman of at least five years' actual experience. Appointments to the board are to be made by the chief of the district police. Examinations are to be held at such times and places as in their judgment seems best.

It is further provided that the records of the board shall be accessible to the public. The fee for a master's license is placed at $5.00, and that for a journeyman at $3.00. In the event of failure to pass an examination no application for another examination shall be entertained for a period of six months. All persons, however, who can satisfy the State Board of Examiners that they have had at least five years' actual experience as journeymen shall be given a license without examination.

Penalties are provided for those who conduct their business without a license. At a public hearing March 3, W. R. Jennison, of Fitchburg, opposed the bill as a master fitter. It is understood that the journeymen favor the measure.

New Jersey Bill to Separate Contracts.

Through the initiative of Joseph A. Sprouls, chairman of the New Jersey State Association of Master Plumbers' legislative committee, a bill has been presented to the State legislature providing that where the cost of public buildings in the State shall exceed $1,000, separate plans and specifications shall be prepared "for the plumbing and gas fitting, and all work kindred thereto, and of the steam and hot water heating and ventilating apparatus, steam power plants and work kindred thereto, and electrical work," and also for the separate awarding of contracts for these portions of the work. Efforts are being made to secure the passage of the bill at the present session of the legislature.

How to Avoid Leaks in Radiators.

At a recent meeting between an architect, an owner and a building manager, at which plans for a new building were under discussion, the building manager in laying out heating equipment made this interesting statement:

"Before the radiators are installed in any building that I have anything to do with I take pains to shut off a certain form of tenant kickery by a little extra investment. I insist that each radiator be connected with a high-pressure hose and water be run through it with the sections upside down for five minutes. Then I have the radiator connected with a 30-lb. compressed air pipe and the air is forced through until a fine piece of muslin placed at the outlet pipe fails to catch any sand particles.

"It is a possible residue of core sand that I'm after. If this is allowed to remain in the pipe the grains get down into the valve seat and in a very short time I have my tenants about my ears complaining about leaky radiators. The danger of a leak starting in a radiator at night and doing a great deal of damage to floors and ceilings is abated at the very start. The extra cost of this work when the building is going up pays me handsomely, for I seldom have a report of a leak from any tenants."

A New Friction Head Slide Rule for Heating Work and Power Piping.

A new slide rule for steam heating, hot water heating and steam power piping has been designed by Charles D. Allan, mechanical engineer, 230 South La Salle street, Chicago, known as the Allan friction head slide rule. It has recently been placed on the market by The Keuffel & Esser Co., New York.

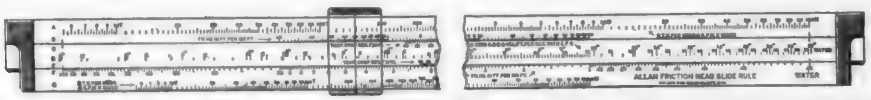
Mr. Allan states that the slide rule was suggested by the charts in Konrad Meier's work on "Mechanics of Heating and Ventilation." He noticed that only four variable quantities can be charted on logarithmic paper so that, in the case of hot water heating, a separate chart is required for each temperature drop, while in steam work a separate chart is required for each gauge pressure. As the slide rule covers this fifth variable, it naturally makes the range of information covered by the rule much geater than anything which exists in pipe tabulation.

The five variable quantities in the design of steam and hot water heating and steam power piping are the volume of flow, loss of pressure due to friction, diameter of pipe, velocity of flow and the drop in temperature in hot water heating, or the gauge pressure in steam work. The range of information to be covered is as follows:

Water, volume, 5,500 to 100,000,000 B. T. U. per hour.

Water, volume, 0.55 to 10,000 gal. per minute.

Water, friction, 0.01 to 100 ft. per 100 ft.
Water, velocity, 0.7 to 25 ft. per second.
Water, diameter, ½ in. to 26 in. O. D. (commercial sizes).
Water, temperature drop, 10° to 40° F.
Steam, volume, 4,500 to 65,000,000 B. T. U. per hour.
Steam, volume, 4.5 to 65,000 lbs. weight per hour.
Steam, friction, 0.01 to 100 lbs. per square inch per 100 ft.
Steam, velocity, 7 to 250 ft. per second.
Steam, diameter, ½ in. to 26 in. O. D. (commercial sizes).
Steam, gauge pressure, 1 to 10 lbs. per square inch (heating).



ALLAN SLIDE RULE FOR FIGURING HOT WATER HEATING CALCU LATIONS.

ALLAN SLIDE RULE FOR FIGURING STEAM HEATING WORK AND STEAM POWER PIPING.

Steam, gauge pressure, 50 to 250 lbs. per square inch (power).

To compute and arrange these data in tables or charts would involve an amount of labor that would be prohibitive. Unusual pains have been taken to make the manual, which accompanies each rule, clear and comprehensive.

The theory of the rule is first explained by an equation of general form and afterwards all of the actual equations on which the logarithmic gradations are based are given in full.

The method of operation is illustrated not only by practical examples involving single pipe lengths, but is carried much further by means of cuts of complete piping diagrams fully worked out for steam and water. In hot water heating, the use of the rule in both forced circulation work, is described, and a special table is provided giving the resistance of valves, fittings, etc., in terms of equivalent length of pipe of the same diameter.

The Allan slide rule is 20 in. long, made of mahogany, with graduations on white facings and is of the duplex pattern, the water scales being on one face and the steam scales on the other. It is provided with the latest patented feature for making adjustment which may be required by reason of wear or variation of atmospheric conditions and has the new Keuffel & Esser frameless glass indicator. It is listed at $15.30, including manual, and will be sent postpaid on receipt of purchase price by Charles D. Allan.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

DRAFT—

Draft for Steam Boilers. Chas. L. Hubbard. Chimneys, fans, and steam jets for supplying natural or artificial draft. 2,500 w. Natl Engr—Jan., 1915. 20c.

FANS—

Electric Fans in the Winter. Percy W. Gumaer. Explains how they may be installed in the cold-air intakes of furnaces to increase temperature and reduce coal consumption. 1,000 w. Elec Wld—Jan. 23, 1915. 20c.

HOTELS—

Heating and Ventilating Plant in the Palace Hotel Bellevue in Berne (Die Heizungs-und Luftungsanlagen im Palace-Hotel Bellevue in Bern). L. Greiner. Detailed plans with brief description. 2,000 w. Schweiz Bau—Jan. 9, 1915. 60c.

PIPING—

Heat Losses and Economical Design of Steam Piping. A. Langstaff Johnston, Jr. Discusses the laws governing the flow of steam in pipes, and presents curves with explanation of their use. 4,000 w. Engng Mag —Feb., 1915. 40c.

POWER PLANT APPARATUS—

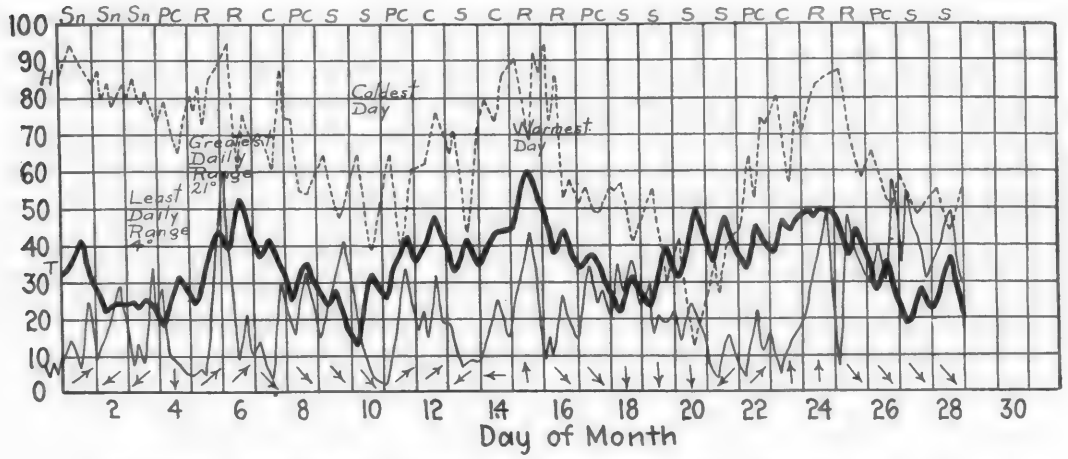
Chronology of Power Plant Apparatus. Charles J. Mason. The steam indicator; its history and improvements, is discussed in this article. Ills. Serial, 1st part 2,300 w. Natl Engr—Jan., 1915. 20c.

VENTILATION—

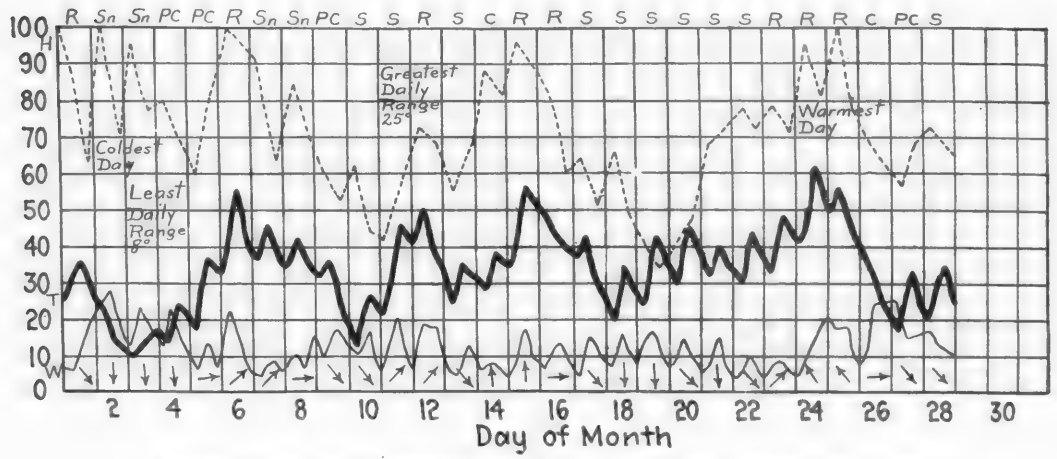
Ozone in Ventilation. J. C. Olsen and William H. Ulrich. An exposition of faulty methods of investigation heretofore employed. 3,500 w. Sci Am Sup—Jan. 16, 1915. 20c.

The Weather for February, 1915.

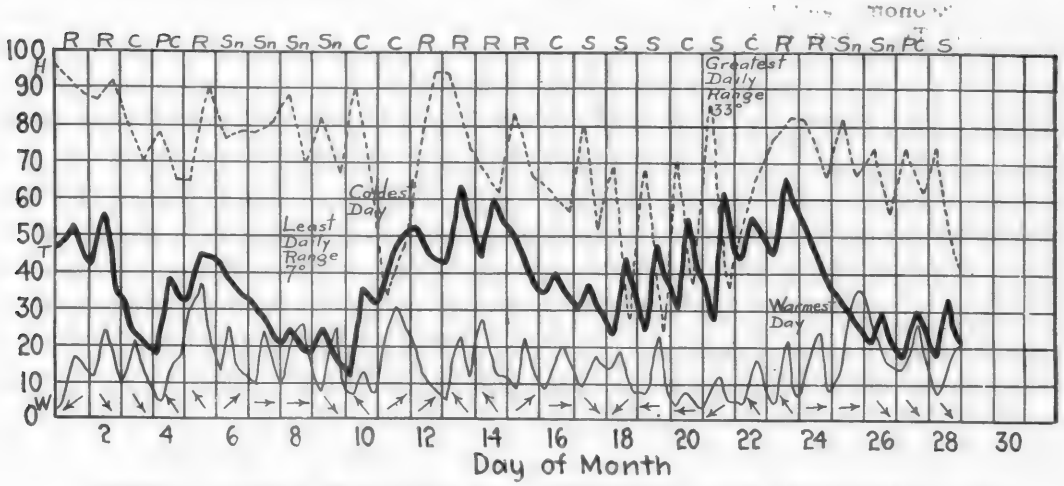
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F	60	61	66	59	69
Date of highest temperature	15	24	23	13	12
Lowest temperature, degrees F	13	10	12	15	21
Date of lowest temperature	10	2	10	7	8
Greatest daily range, degrees F	21	25	33	24	26
Date of greatest daily range	5	11	21	13	10
Least daily range, degrees F	4	8	7	4	6
Date of least daily range	3	3	8	24	27
Mean. temp. for month, degrees F	35.2	33	37	34.5	40.5
Normal mean temp. for month, degrees F	30	28	31.8	25.4	33.5
Total rainfall, inches	5.03	3.47	2.24	1.92	2.3
Total snowfall, inches	4.5	5.1	1.5	0.5	1.6
Normal precipitation, this month, in.	3.74	3.44	2.66	2.16	2.75
Total wind movement, miles	13358	7475	8052	8570	10796
Average hourly wind velocity, miles	19.9	11.1	12	12.8	16.1
Prevailing direction of wind	N.W.	N.W.	N.W.	S.E.	S.
Number of clear days	9	10	7	7	5
Number of partly cloudy days	7	8	3	4	8
Number of cloudy days	12	10	18	17	15
Number of days on which rain fell	9	12	14	11	8
Number of days on which snow fell	3	4	6	4	1
Snow on ground at end of month, inches	..	..	..	..	..



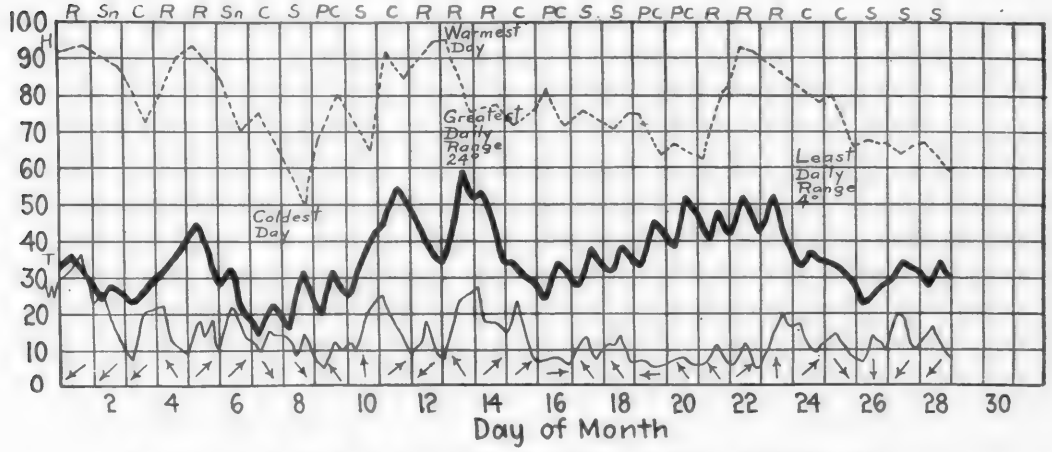
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1915.



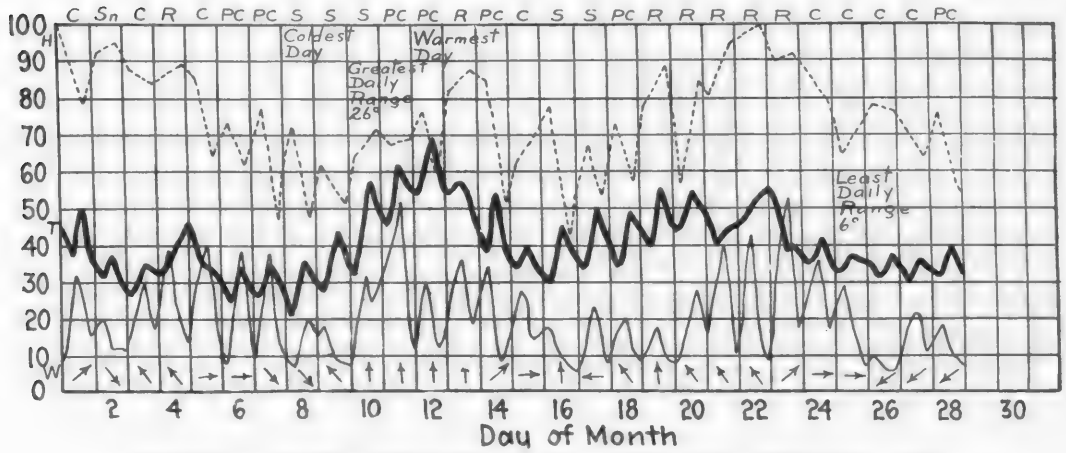
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1915.


R R C Pc R Sn Sn Sn Sn C C R R R R C S S S C S C R R Sn Sn Pc S
Greatest Daily Range 33°
Coldest Day
Least Daily Range 7°
Warmest Day
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR FEBRUARY, 1915.


R Sn C R R Sn C S Pc S C R R R C Pc S S Pc Pc R R R C C S S S
Warmest Day
Greatest Daily Range 24°
Least Daily Range 4°
Coldest Day
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1915.


C Sn C R C Pc Pc S S S Pc Pc R Pc C S S Pc R R R R R C C C C Pc
Coldest Day
Warmest Day
Greatest Daily Range 26°
Least Daily Range 6°
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1915.

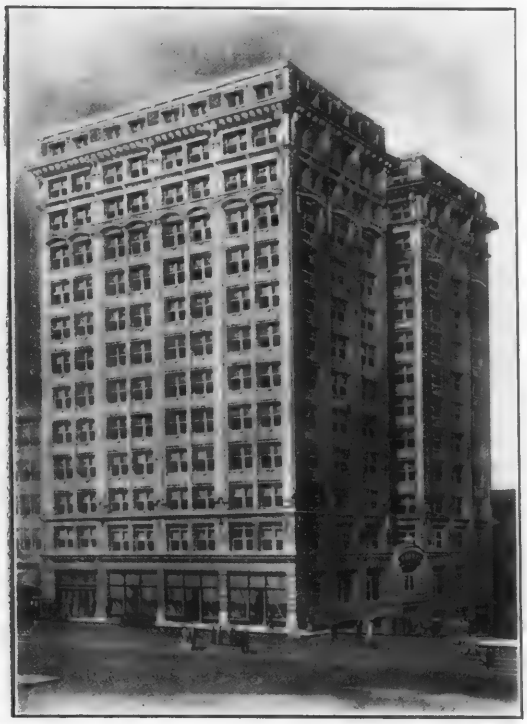
Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

Test of Economy and Efficiency of Automatic Temperature Regulation in Office Buildings.

By F. A. Boos.

In order to determine closely the economy and efficiency of automatic temperature regulation in office buildings, a test was made in the Rialto Building, Kansas City, Mo., for the Johnson Service Company, by F. A. DeBoos and O. G. Ward, graduates of the College of Engineering, University of Wisconsin.

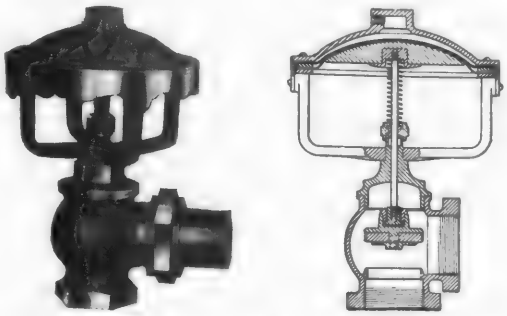
The room selected for the test was on the third floor, on the northeast side of the building. The room was of the following dimensions: 10 ft. 3 in. high, 15 ft. 2 in. long and 12 ft. 4 in. wide. Two windows on the 12 ft. 4 in. side had an area of approximately 50 sq. ft. The radiator was of about 45 sq. ft. area, being a two-column, 26 in., 17 section type. The steam riser was in one corner of the room and was covered. A branch line (uncovered) connected this riser with the radiator which was less than 2 ft. away. Heat was supplied by an overhead distribution, single pipe, air line vacuum steam system.



Smith-Rea-Lovitt, Architects
RIALTO BUILDING, KANSAS CITY, MO.

In making the test it was desired to know just how often the diaphragm radiator valve was opened and how long it remained open during each operation; also how closely the temperature was kept to the desired degree by the operation of the thermostat. To obtain this data, a Bristol recording thermometer and a Bristol recording pressure gauge were used and these were placed as shown in the accompanying illustration.

The recording gauge was connected to the air line leading from the thermostat to the diaphragm radiator valve. Thus when the thermostat operated, air pressure would be



TYPE OF DIAPHRAGM RADIATOR VALVE USED IN TEST.

thrown from the main air supply into the branch air line leading to the valve, and this pressure would be recorded graphically on the pressure gauge chart.

This diaphragm valve is operated by compressed air and it is so arranged that when air pressure is thrown on the diaphragm, it is forced downward. As the diaphragm bears directly upon the valve piston, it forces it downward, and thus shuts off the steam supply to the radiator. When the air pressure is released, a spring forces up the diaphragm and the valve is automatically opened. The thermostat is so arranged as to turn this compressed air into the branch leading to the diaphragm radiator valve, or release it from same, at slight temperature variations, and this control is designed to keep the temperature at almost a uniform point. When air is admitted at the top it forces the diaphragm down, as can be seen by noting the valve construction in the accompanying illustration.

The recording thermometer was hung as close to the thermostat as possible, so that there could be no difference in temperature at that point. The frames of the two instruments were thus made to touch. The thermostat was approximately 10 ft. from the radiator. The recording thermometer gave a continuous record of the temperature at the thermostat.

The thermostat first used was of the positive type, and this instrument is so arranged that when the valve is closed the full air pressure is thrown on the diaphragm valve and this is approximately 15 lbs. When the air pressure is released, it is released entirely, the pressure dropping to zero. The valve

therefore, is either in a fully open or a tightly closed position.

It must be remembered in speaking of pressures that *air pressures* are meant and not *steam pressures,* as no record was taken of the steam pressures, the air pressures being obtained simply because they afforded a means of recording the opening and closing of the diaphragm radiator valve.

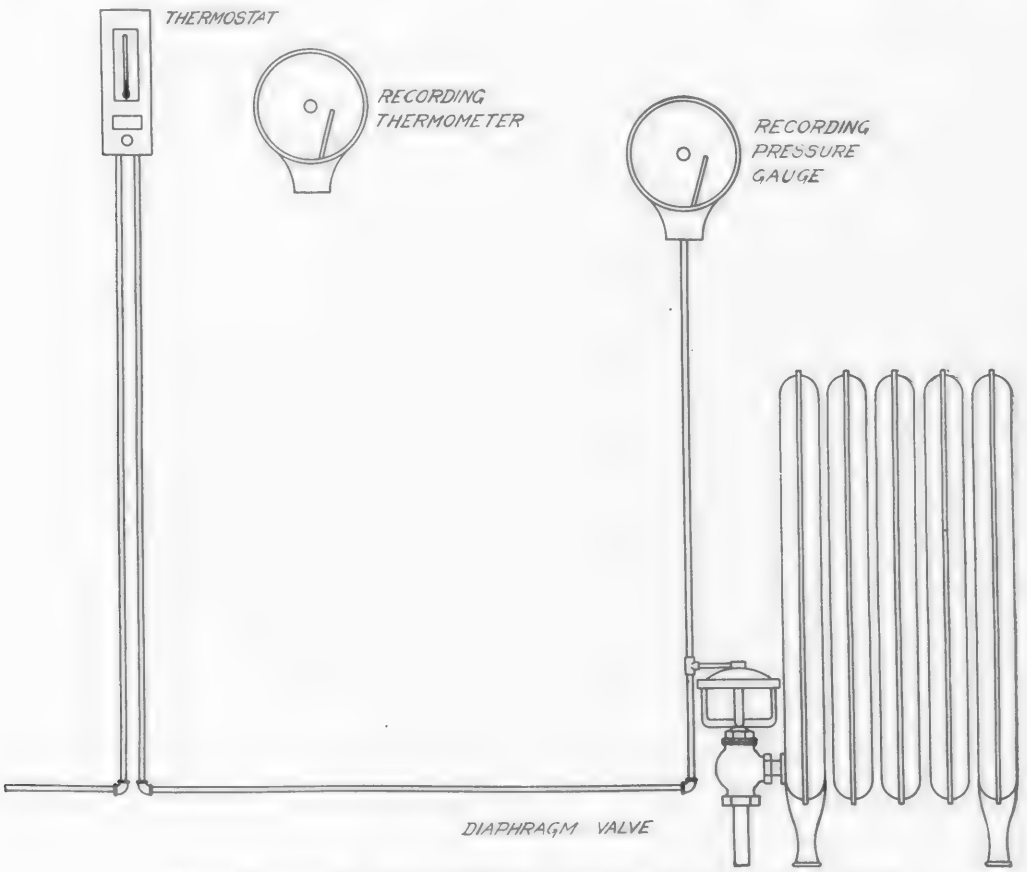
On the recording thermometer charts was later plotted in dotted lines the outdoor temperatures, which were taken from the U. S. Government records in the weather bureau office in Kansas City. These offices are directly across the street from the Rialto Building.

The tests were made by The Johnson Service Company with the co-operation of the owners of the building. The engineer in charge of the building, J. H. Duncan, assumed general charge, keeping the gauges under lock and key during the progress of the tests.

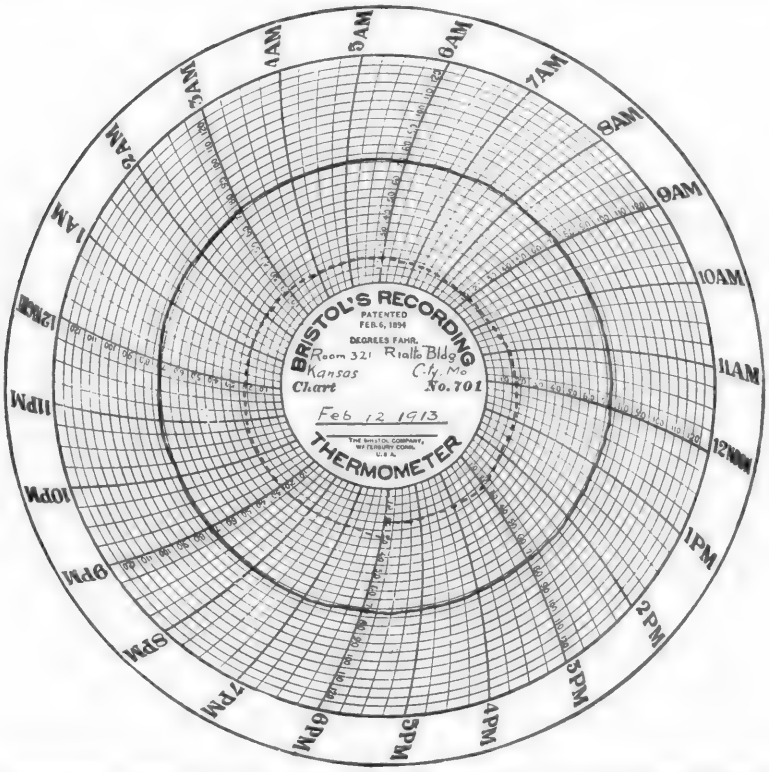
The coldest weather experienced during the test was on February 12, when the temperature varied from 11° F. to 29° F. This may be considered as severe winter weather for Kansas City and is somewhat colder than the average winter day. February 22 was also a day of severe winter weather, the temperature averaging but 1° higher than on February 12.

The two charts for February 12 are shown herewith. These should be studied together as they are inter-related, the temperature varying, of course, as the diaphragm valve is opened and closed. On the recording thermometer chart the outside temperature is shown by dotted lines. The variations in the air pressure on the recording pressure gauge chart (variations between 14½ and 15 lbs., making a slightly waving line) are caused by the operation of the automatic air compressor which operated about once in 15 minutes.

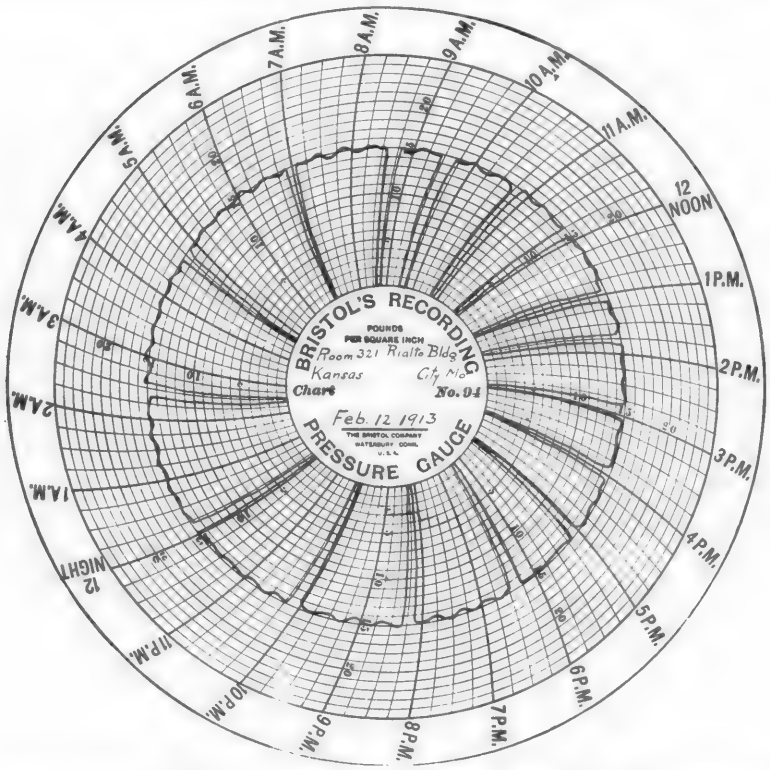
From an inspection of the recording thermometer chart it will be noticed that the outside temperature was 29° at 6:00 P. M. and went down steadily to 11° at about 8:00 A. M., and was about 20° above zero at 6:00 P. M., an average of about 19.5° F. for the 24-hour period. The indoor temperature was maintained between 70.5° and 72.5° F., or a little



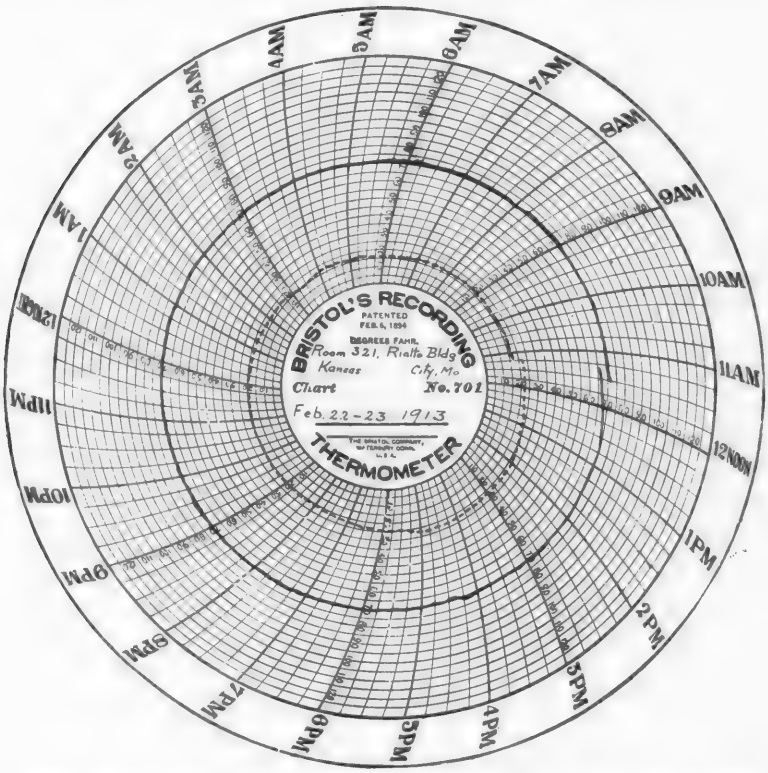
ARRANGEMENT FOR TESTING AUTOMATIC TEMPERATURE REGULATION APPARATUS.



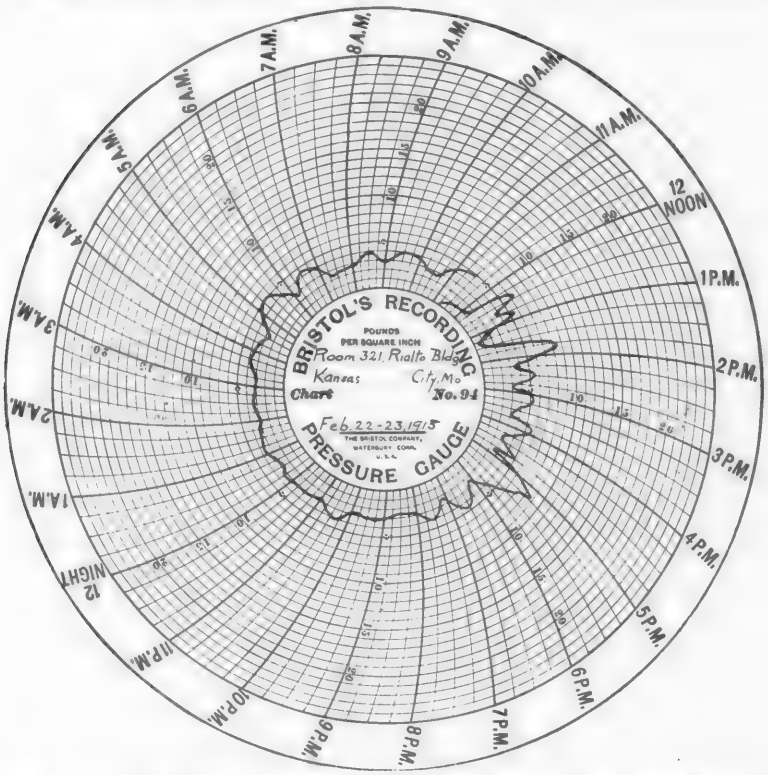
TEMPERATURE CHART FOR FEBRUARY 12, RIALTO BUILDING.



AIR PRESSURE CHART SHOWING OPERATION OF AUTOMATIC AIR COMPRESSOR FOR FEBRUARY 12, RIALTO BUILDING WHEN POSITIVE THERMOSTAT WAS USED.



TEMPERATURE CHART, FEBRUARY 22-23, RIALTO BUILDING.



AIR PRESSURE CHART SHOWING OPERATION OF AUTOMATIC AIR COMPRESSOR FOR FEBRUARY 22-23, RIALTO BLDG., WHEN INTERMEDIATE THERMOSTAT WAS USED.

higher than 50° above the average outdoor temperature.

The pressure chart shows the thermostat operated 32 times, opening the valve at 16 different times and closing same 16 times at short intervals. In fact, the valve was held open only from 5 to 10 minutes at a time, or approximately 2 hours out of the entire 24, or about 8% of the time. It will be observed that the indoor fluctuations of the temperature follow the valve operations very closely, lagging a little behind same, as would be expected.

For instance, it will be observed on the recording thermometer chart between 12:00 noon and 1:00 P. M. the temperature is gradually falling from about 72° till just about 1:00 P. M. it almost reaches 70°. By now referring to the recording pressure chart, it will be noted that at about 12:55 the thermostat operated, releasing the air pressure (which dropped at once to zero) thus permitting the valve to open and to turn heat into the radiator.

Inside of ten minutes (at about 1:05 P. M.) the room temperature has risen to almost 71° and this slight increase of less than 1° is sufficient to cause the thermostat to again operate to close the valve, as is shown by the pressure jumping up to 15 lbs. on the pressure recording chart. The temperature, however, still rises another fraction of a degree, due to the fact that the radiator is hot and although the steam is shut off, it continues to radiate heat for a brief interval.

At about 1:15 P. M. the temperature again begins to fall slightly and at about 1:37 P. M. the thermostat operates to let in more steam. At about 1:47 P. M. the thermostat again operates shutting the radiator valve and cutting off the steam supply. The temperature increases slightly, however, for a few minutes when it begins to fall again, and the thermostat operates once more at about 2:50 P. M.

The thermostat operates in each case on less than 1° variation in the room temperature. As would be expected it operated more frequently while the outdoor temperature was around 10° to 15° than it did during the time the outdoor temperature was fluctuating between 20° and 30°.

During the next several days the weather moderated to such an extent as to permit the steam being shut off the building at night and the records, while kept, do not afford anything of special interest. The thermostat operated with less frequency, of course, as the weather moderated.

Another cold wave came on February 22, and it was decided to test out an intermediate thermostat, substituting it in place of the positive. This instrument is so designed as to throw varying pressures on the valve diaphragm so as to hold it in all sorts of positions from fully open to tightly closed, and also at all intermediate stages.

The pressure record, while interesting, does not afford sufficient data to show just how long the radiator was actually in full operation. For a very considerable part of the time, after the room had reached the desired temperature, the thermostat held the valve in a slightly open position, permitting just enough steam to enter the radiator to keep it slightly warm thus causing hardly any fluctuation of the indoor temperature. The two charts are shown herewith.

When the test was started at 11:15 A. M. the room temperature was 65° F. At 12.30 it reached 70° and it will be noted that from 12:15 on till 12:30 the thermostat kept increasing the air pressure upon the diaphragm valve till it reached 6.5 lbs., which was just about sufficient to close it. The temperature began to drop just a fraction, and the thermostat began releasing the air and permitted the valve to open more and more until about 1:30 P. M. it had the valve practically fully open. The temperature began to rise and the thermostat immediately began closing the valve, piling up a pressure of about 8.5 lbs. in the next fifteen minutes.

From that time on it seems to have struck a "happy medium," holding the valve open just sufficiently to permit exactly the right amount of steam to enter the radiator, although at 5:00 P. M. the intermediate thermostat had built up a pressure of 9 lbs. which was gradually diminished to 2.5 lbs. during the next hour. The thermostat seems to have then struck a still *"happier medium"* and for the next several hours hardly varied the pressure more than 1 lb. on the diaphragm valve. The temperature was maintatined at a remarkably uniform point as shown by the recording thermometer chart.

The charts for the days, Feb. 12 and Feb. 23, are selected from the others simply for the reason that they were the two coldest days encountered. The tests were not begun until Feb. 12, and the weather moderated so much after the 23rd that it was decided to stop the tests, as little new information could then be derived.

The results of these tests tend to show that a reliable system of temperature regulation is a great fuel saver. A correctly designed plant, properly installed, and equipped with automatic temperature control would require perhaps 25% less radiation than one not so equipped. A fuel saving, 25% at the minimum, should be expected.

Future tests will probably be made in more

detail at a later date, covering records for an entire winter and taking into consideration the steam pressures, condensation, etc., and also including data for comparison on room temperatures, steam consumption, etc., of buildings of similar character which are not automatically controlled.

M. S. Cooley Enters Vapor Heating Field.

As announced last month, in the notice of the reorganization of the Hutchison Vapor Heating Corporation, of Washington, D. C., the position of chief engineer of the corporation has been taken by M. S. Cooley, formerly assistant superintendent of the Mechanical Division, Supervising Architect's Office, United States Treasury Department. Mr. Cooley is a graduate of Cornell University, taking his M.E. degree with the class of '96. Immediately after his graduation he was employed in various positions controlled by the architect of the State of New York and, for the past twelve years, as heating and ventilating engineer of the Supervising Architect's office of the Treasury Department. He has superintended the design and installation of the heating plants in all public buildings during that period. He is a member of the American Society of Heating and Ventilating Engineers to which he has contributed a number of papers on heating and vacuum cleaning subjects. He is also the author of the well-known work on "Vacuum Cleaning Systems." Mr. Cooley's many friends will wish him a full measure of success in his new position.

Operating Costs of Electric Heating Devices.

In connection with the use of electric radiators for warming purposes, the following figures are given as applying to the Apfel electric heating devices, which were illustrated and described in the last issue. This system, it is claimed, is actually 100% efficient; that is, every B.T.U. generated is generated and used at the point where it is desired, and not in a boiler room or in a basement, whence it must be conveyed, with more or less loss, to the rooms where it is to be used. In this way all losses of circulation and insulation are eliminated.

It is figured that, with the Apfel system, 1 K.W. of energy will properly and amply heat 30 sq. ft. of direct radiating surface. In Washington, where the system has been developed, the coals average 11,000 B.T.U. per pound. The average cost of Washington coal, delivered in a residence basement, is $7.00 per ton. The average net efficiency in available B.T.U. delivered from the radiator into the room where it is desired will not exceed 19.2%, after the flue losses, radiation losses from boiler and mains, and energy losses of friction and circulation are deducted. Therefore, from the above figures, with an electric heating system which is 100% efficient, it is shown that electricity at 56 cents per kilowatt hour is the full equivalent of coal in that State.

In support of the foregoing we are informed that in the offices of the Great Western Stove Company, in Seattle, which was formerly equipped with a hot water heating system, the coal bills for two years, covering a heating season of seven months each year, averaged slightly over $8.00 per month. Since installing the Apfel electric heating system last Fall, the largest bill for the coldest month was a little over $9.00. The reason for this is explained on the ground that the heat is turned on automatically at 5 or 6 A. M. and turned off again as soon as the offices are warmed.

In another case, in a seven-room Seattle residence, containing over 400 sq. ft. of direct radiation, where the electric radiators used are wound for a consumption of less than 30 watts per square foot on the high heat, the entire house is fully heated to 70° F., or over, except at night or at such times as the occupants are out for the day, when the time switch is set to turn on about 1½ hours before their return, so that the house will be warm at that time. The total cost for the heating of this residence during the winter of 1913-1914 was $88.00. The heating plant received absolutely no care or attention during that time, except that the time switch was set at night or when going out for the day. Nothing was paid for repairs or renewals of any nature.

New Books.

500 PLAIN ANSWERS TO DIRECT QUESTIONS on steam, hot water, vapor and vacuum heating, is the title of a new book by Alfred G. King. This work is intended primarily for the younger inexperienced fitter, but many of the older men in the trade will find it useful as a reference book. The text is arranged in question and answer form and is always to the point. In case the proposed licensing laws are passed in such States as Pennsylvania and Massachusetts, as seems likely, the book will have a very timely value in aiding those who may then be preparing for examinations. The subjects treated by the questions and answers include: Theory and laws of heat; methods of heating, chimneys and flues, boilers for heating, boiler trimmings and settings, radiation, steam heating, hot water heating, including two-pipe gravity work, circuit systems and overhead systems;

accelerated hot water heating, vacuum vapor and vacuo-vapor heating, mechanical systems of vacuum heating, and greenhouse heating. Size 6¼ x 9¼ in. Pp. 200, 127 ills. Published by the Norman W. Henley Publishing Co., 132 Nassau Street, New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

DESIGNING, HEATING AND VENTILATING SYSTEMS, by Charles A. Fuller, is one of the interesting new books of the year, embodying the data contained in the lecture courses given by the author before Y. M. C. A. and other classes. The work covers the practical application of engineering rules and formulas in every-day use, in designing all types of heating and ventilating equipment. The needs of the less technical mind have been considered throughout and no attempt is made to explain the derivation of the rules used. The fact that the author has applied the formulas in his own work as a consulting engineer is given as sufficient evidence of their reliability. Among the most useful features of the book are the typical problems in the solution of which the reader is called upon to apply the information immediately preceding. In many cases the solution is presented in detail. A chapter on hotel ventilation shows the importance of the problem of kitchen ventilation. Many useful hints are given covering the ventilation of ranges and other cooking apparatus. Size 6 x 9 in. Pp. 220, 78 ills. Published by the David Williams Co., 239 West 39th Street, New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

CORK: ITS ORIGIN AND INDUSTRIAL USES, by Gilbert E. Stecher, is the title of a timely monograph, published to supply little-known facts regarding this valuable staple. Although the book does not go into the insulating properties of cork, those who are interested in knowing its nature as well as the history of the cork industry, will find much to enlighten them in this manual. Among the subjects discussed are the origin of corkwood, including the territory of growth and attempts to transplant the seed. Size 5½ x 8 in. Pp. 83. Price, $1 net.

ADVERTISERS' INDEX

Alberger Condenser Co..... 82
American District Steam Co., Inside Front Cover
American Blower Co..... 70
American Radiator Co.....Back Cover
Armstrong Mfg. Co..... 61
Bicalky Fan Co..... 12
Bishop-Babcock-Becker Co. 8
Bristol Co., The.....Front Cover
Buffalo Forge Co., The..... 5
Carrier Air Conditioning Co..... 64
Central Station Steam Co..... 82
Century Ventilating Co..... 64
Connersville Blower Co..... 3
Davis Regulator Co., G. M..... 8
Detroit Lubricator Co..... 65
Dixon Crucible Co., Joseph..... 80
Dunham Co., C. A..... 12
Foster Engineering Co..... 6
Globe Ventilator Co.....Front Cover
Gurney Heater Mfg. Co.....Front Cover
Hornung, J. C..... 82
Hutchison Vapor Heating Corporation. 76
Ilg Electric Ventilating Co..... 4
Industrial Instrument Co..... 63
Jenkins Bros. 63
Johns-Manville Co., H. W..... 81
Johnson Service Co..... 66
Kelsey Heating Co..... 73
Kernchen Co., The..... 10
Keuffel & Esser..... 3
Knowles Mushroom Ventilator Co., Front Cover
Marsh Co., Jas. P..... 6
Michigan Pipe Co.....Front Cover
Mouat-Squires Co. 76
Mueller Mfg. Co., H..... 7
Parker Supply Co..... 73
Patterson & Co., Frank....Inside Back Cover
Patterson Publishing Co..... 77
Powell Co., The Wm..... 77
Pressed Metal Radiator Co..... 9
Ric-Wil Underground Pipe Covering Co. 62
Ross Valve Co.....Front Cover
Sarco Engineering Co..... 7
Scaife Sons Co., Wm. B..... 77
Sims Co., The.....Inside Back Cover
Spencer Turbine Cleaner Co..... 80
Standard Thermometer Co..... 62
Standard Wood Pipe Co..... 77
Sturtevant Co., B. F.....69-71
Syracuse Faucet & Valve Co..... 81
Taylor Instrument Companies..... 68
United Vacuum Appliance Co..... 10
Webster & Co., Warren..... 67
Wells & Newton Co..... 67
Westinghouse Electric & Mfg. Co..... 72
Wyckoff & Sons Co., A..... 80
*Zellweger & Sons, J..... —

*Every other month.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 11-13, 1915.—Annual convention of the National Pipe and Supplies Association, in Buffalo, N. Y. Headquarters at the Hotel Lafayette. Secretary, George D. McIlvaine, Oliver Building, Pittsburgh, Pa.

June 1-3, 1915.—Seventh annual convention of the National District Heating Association in Chicago, Ill. Headquarters at the Hotel Sherman. Secretary, D. L. Gaskill, Greenville, O.

June 21-24, 1915.—Twenty-seventh annual convention of the National Association of Master Steam and Hot Water Fitters in Milwaukee, Wis. Secretary, H. B. Gombers, 260 West Broadway, New York.

Third Monday in East Month.—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies Building, New York (evening). Secretary, Wallace F. Goodnow, 104 West 42d Street, New York.

Second Monday in Each Month.—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening). Secretary, W. L. Bronaugh.

Third Tuesday in Each Month.—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening). Secretary, Charles Morrison, 31 Union Street, Boston, Mass.

Deaths.

Andrew M. Morton, of Andrew M. Morton & Co., Boston, Mass., dealers in pipe and fittings, died at his home in Brighton, March 1. He was 76 years old. Mr. Morton was one of the early figures in the pipe trade in Boston, where he had been engaged in business for more than fifty years. He leaves a son, A. Marcus Morton, who has been associated in business with his father.

Charles A. Schieren, founder of the firm of Charles A. Schieren & Co., New York, leather belt manufacturers, and millionaire philanthropist and former mayor of Brooklyn, died March 10 of pneumonia. He was 73 years old. His wife, who contracted the same disease, died the following day. Mr. Schieren leaves four children.

Daniel J. Rock, first president of the Chicago Master Plumbers' Association, and well known in the heating and plumbing trade in that city, died at his home in Lakeview February 23. He was 80 years old. Mr. Rock had been connected with the heating and plumbing business since 1860, barring the period of the Civil War in which he served with the 90th Illinois Infantry.

Miscellaneous Notes.

C. B. Peck, New York, has resigned his position with the New York branch of the B. F. Sturtevant Co., Hyde Park, Mass., and after May 1 will be associated with Blake & Williams, heating engineers and contractors, 26 Grove Street, New York.

American Institute of Chemical Engineers will hold its seventh semi-annual meeting in San Francisco, August 25-28.

National Metal Trades Association, Chicago branch, held its annual meeting and

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

Manufactured by **Write for Catalog**

THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

dinner at the Hotel Sherman, Chicago, March 5. The following officers were elected: President, A. T. Whiting, Whiting Foundry Equipment Co.; treasurer, O. A. Olsen, Simonds Mfg. Co.; vice-president, L. C. Walker, Aermotor Co.; secretary, Paul Blatchford. The speakers included Frank C. Caldwell, H. D. Sayre and N. W. Dingwall.

Central Supply Association held its sixty-seventh regular meeting in Chicago, Feb. 24, at the Auditorium Hotel. President C. V. Kellogg presented a timely paper, giving the consensus of opinion of several legal authorities on the application of the so-called Clayton Bill, as related to the business of the members of the association. He also reviewed the United States Trade Commission Bill in the light of its effect upon business and concluded his remarks with a general summary and his own opinion on some of the legal features. Following a buffet luncheon addresses were made by J. B. Vaughn, chairman of the Industrial Board, State of Illinois, on "Employees' Compensation and Employers' Liability," and by Dudley Taylor, attorney of the Employers' Association of Chicago and the Associated Employers of Illinois on "State Legislation and What the Business Man Can Accomplish." An attendance of 175 representatives was registered.

Eastern Supply Association held its regular quarterly meeting in New York, February 17, at the Hotel Astor, with a record attendance. Addresses were delivered by F. D. Van Amburgh, editor of The Silent Partner, New York, on "How to Avoid Failure," and by John Clyde Oswald, president of The American Printer, New York, and of The American Federation of Trade Press Associations, on "Cost System and Organization." W. S. Kies, manager of the foreign department of the National City Bank of New York discussed the subject of foreign trade opportunities and urged that more attention be paid to the teaching of Spanish, German and French in the schools, rather than Latin and Greek. He offered his knowledge as to conditions in South America to the members of the association and urged them to call upon him for further information regarding trade opportunities abroad. John A. Murray reported the convention of the United States Chamber of Commerce, to which he was a delegate.

Seattle, Wash.—Among the important building operations in Seattle, totaling over $4,000,000, are the King County court house, $1,250,000; Rainier Heat & Power Co., hotel, $300,000; Port of Seattle Grain Theatre, $350,000; Port of Seattle storage warehouse, $500,000; O'Shea loft building, $100,000, and the Sears-Roebuck Store, $850,000.

New York.—Six members of the New York City Association of Master Plumbers were indicted March 6 charged with conspiracy to make a former bankrupt pay a balance not legally due on an old claim. They were held in $1,000 bail each. They are Milton Schnaier, 345 Columbus Avenue, president of the Credit Men's Associa-

Ric-wiL MethoD
of
Insulating Underground Pipes

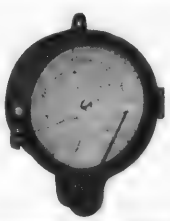
Double Insulation — Diatomite composition moulded onto the conduit. (Conduit is serrated to hold insulation.) Loose Non-settling Ric-wiL Asbestos Silica Fibre.

Perfect Underdrainage— The life of any underground heating system. Ric-wiL Interlocking Base Drain always insures a dry ditch.

Highest Efficiency—Lowest Installation Cost—Permanent

The Ric-wiL Underground Pipe Covering Co. 623 New England Bldg. CLEVELAND OHIO

Your Choice of Seven Types
is offered in our line of
Standard Recording Thermometers
We make a specialty of hot water and steam indicators
Send for Catalogue VH
Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.



Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

tion of the Building Trades; John J. Hannegan, 161 Columbus Avenue, president of the Association of Master Plumbers; Thomas F. McCaul and John R. Hopkins, members of the joint conference board of the association, and John J. McGrath and John D. Gunn, of the claims committee of the association.

Harry Schiff, a builder, appears in the indictment as the person injured by the conspiracy. According to the indictment he was president of the West Eighty-second Street Realty Company in 1913 and was erecting a building at 105th Stréet and Broadway.

Creditors threw him into the hands of a receiver. He was discharged from bankruptcy after paying 65 cents on the dollar. Schnaier had the plumbing contract for this building, and he received $7,350 less than his contract called for.

Last June Schiff began other building operations. With Marcus Brown as his backer, he organized the Essie Construction Company and began work on a building at Ninety-sixth Street and West End Avenue. He asked for bids on the plumbing. Then the conspiracy began, according to the indictments. Schnaier induced several master plumbers to put in bids to cover his loss of $7,350 on Schiff's previous venture. James S. Cully, a plumber, swore to the Grand Jury that Schnaier offered him a bonus of $700 to do this.

The first bids all exceeded $48,000 except Cully's bid, which was $46,850. Gunn, McCaul and Dunn were other bidders. Bids were asked for again, and Cully offered to do the work for $29,675.

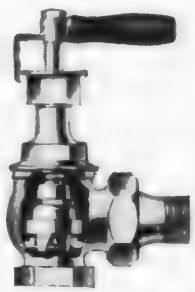
Schnier bid $36,368, and then, Cully says, demanded that he get the contract to be reimbursed for his former loss. Cully got the contract and soon he had labor troubles.

It is charged the six defendants held a meeting and felonously agreed to extort the sum of $7,350 from Schiff. Local 480 and 498 of the United Association of Plumbers and Gas Fitters called a strike. After the Grand Jury took up the matter the men went back to work.

Worcester, Mass. — Heating engineers, architects and others interested in heating plants and boilers were guests of the American Radiator Company at the Chamber of Commerce Hall and of the Central Supply Company at the Bancroft Hotel, where dinner was served the visitors at 6 o'clock. The guests numbered 176. Following the dinner a lecture was delivered by Henry R. Dillon of the American Radiator Company, illustrated by tantern slides, showing, among other things, how heating standard are established and put into practice.

Mattoon, Ill.—A pipe tunnel 14 ft. wide and 5 ft. deep will be constructed in Commercial Alley, connecting the Hotel Byers and hotel's heating plant at the rear of the city building, to obviate future damage to the pavement when repairs to the hotel's heating mains are being made.

Chicago, Ill.—The Appellate Court has reversed a Municipal Court finding of not guilty in favor of the Chicago Railways



Have Your Specifications Read:

"JENKINS BROS. VALVES, with the DIAMOND TRADE MARK,"

and your clients will be certain to obtain good service. The Jenkins Bros. line includes radiator valves of all kinds, and globe, angle, check, back pressure, automatic equalizing stop and check, blow-off—in short, about every type required in the modern steam heating system and power plant. Write for our handy catalogue.

JENKINS BROS.

NEW YORK BOSTON PHILADELPHIA CHICAGO MONTREAL LONDON

SPECIFY FOXBORO THERMOMETERS

TRADE MARK

THE LATEST AND BEST BY EVERY TEST Send for Bulletin No. 73

New York 50 Church St. **The Industrial Instrument Co., Foxboro, Mass.** Chicago Monadnock Bld

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Company, charged with operating cars not properly ventilated. The Appellate Court said no reason appeared why the company did not have a ventilating system in accordance with the ordinance. The cases were ordered retried.

Ottawa, Ill.—A new heating plant for the court house building in Ottawa is being planned in connection with the remodeling of the building. The matter is in the hands of the Board of Supervisors.

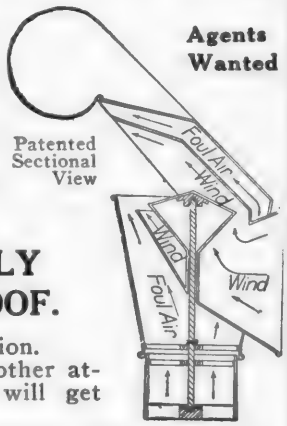
Illinois State Board of Control has approved the bid of the E. Keeler Company, of Williamsport, Pa., for eighteen large boilers to be used in buildings which will be erected by the board this year. This is one of the largest orders ever received by the company in fifty years' business. The boilers will be of two different sizes. Nine are to be 300 H.P. The order amounts approximately to $115,000.

Columbia City, Ind.—A scheme for using the exhaust steam from the city power house for heating the West Ward school buildings, the court house and the city hall, was discussed before the city council at its March meeting. Plans were submitted by Theodore Weinshank, of Weinshank & Fenstermaker, of Indianapolis, which provided for the use of 12-in. mains for this purpose. It was estimated that the cost of

American Standard Automatic Air Pump

Having a Special NO-DOWN-DRAFT feature, it insures a steady upward pull at all times.

Agents Wanted



Patented Sectional View

ABSOLUTELY STORM PROOF.

Needs no attention.
Has no fans or other attachments that will get out of order.
Will give an average displacement at the rate of over 1000 linear feet per minute.

Specified by the New York and Massachusetts Boards of Education.

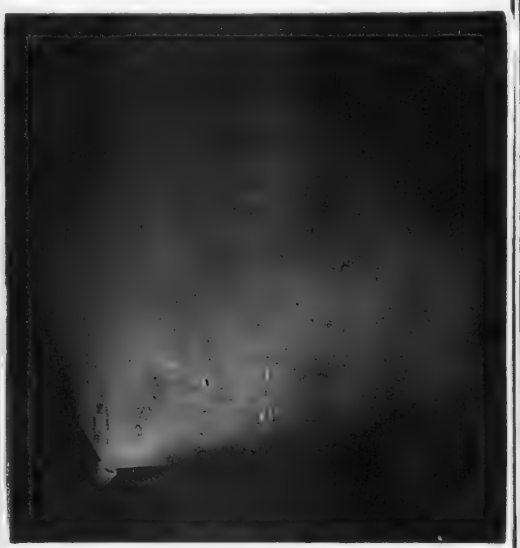
Century Ventilating Co.,
73 Guernsey St., Brooklyn, N. Y.

You get the most efficient product of the best engineering staff in the business when you equip with

CARRIER
Air Washers and Humidifiers

Simple in design, free from all theoretical or untried attachments. Have four times the washing surface, four times as many eliminators and offer less resistance to the air than any other standard washer made.

Write for Catalog 13-36



CARRIER AIR CONDITIONING COMPANY OF AMERICA
39 Cortlandt St. New York, N. Y.

The First Cost Is the Whole Cost

When *"Genuine Detroit Packless Radiator Valves"* are included in the specifications, it means economy and permanent satisfaction for the building owner.

Detroit Packless Valves do not leak around the stem and they never need repacking.

Ordinary valves of the packed type depend upon some loose asbestos packing or oil soaked wicking wound around the stem and held by an ordinary packing nut—that is their only protection against leaking.

Sooner or later this packing wears out—the valves leak around the stem resulting in damaged floors and ceilings, loose plaster, spoiled rugs, furnishings, etc.

Troubles of this kind are entirely eliminated by the installation of

DETROIT PACKLESS RADIATOR VALVES

They are insurance against such troubles on all kinds of steam heating systems. Their design and construction are positive insurance against the annoyance and expense due to leaky Radiator Valves—they are absolutely tight and will always stay tight.

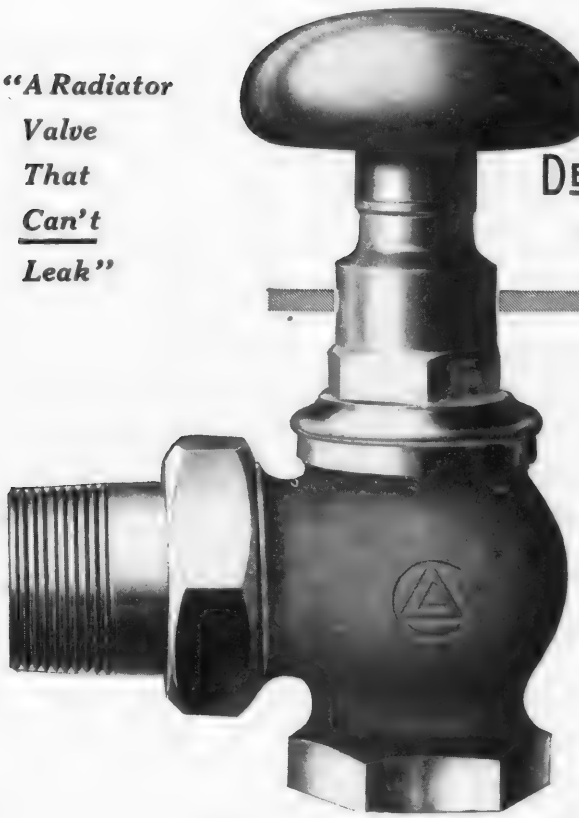
And the building owner and manager appreciate their installation because they never need repacking—because their first cost is the whole cost—and because there is no occasion for having a man spend most of his time keeping them in condition.

The fact that Detroit Packless Radiator Valves are being specified in prominent buildings throughout the country by some of the country's foremost architects is proof positive of their absolute dependability and efficiency.

In addition to their non-leaking feature, the Detroit Packless Valves are unquestionably the most handsome and substantial looking radiator valves ever designed and are finished in a manner to harmonize with the very highest class furnishings.

Booklet V-46, giving complete information on Radiator Valves, will be gladly sent on request.

"A Radiator Valve That Can't Leak"



DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO, CANADA
Mfrs. of Stewart Carburetors Used on White Cars

MASONIC TEMPLE, COLUMBUS, O.
Equipped with Genuine Detroit Packless Radiator Valves

Architects
Stribling & Lum, Columbus

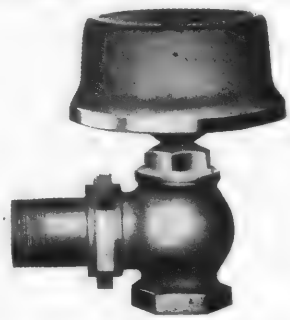
Heating Contractor
Peter Gehr, Columbus

such a system would be about $15,000. It was voted to advertise for bids on the proposition after minor changes had been made in the plans, providing for a change in the pipe line, but the date of such advertising was left until a later meeting.

Bloomington, Ill.—Tests of the heating system in the new shops of the Chicago & Alton Railroad at Bloomington, show these buildings to be efficiently heated. The shops are considered among the largest and most complete of their kind in the United States. They are heated by a hot blast system. Air is drawn through the steam coils and forced by large fans through concrete ducts, with outlets at intervals to allow egress of the heated air. During a recent cold spell when the outside temperature was 18° F. below zero a shop temperature of 65° F. was maintained. This was accomplished with the steam gauges showing a pressure of 7 lbs. In the summer time, if advisable, the system can be used to cool the shop, by using cold water in the coils.

Des Moines, Ia. — Thirty-six master plumbers, members of the National Association of Master Plumbers, who have been on trial in the Federal District Court in Des Moines, charged with violating the Sherman anti-trust law, were found guilty by a jury February 24. The counsel for the master plumbers, L. C. Boyle, was permitted by Judge John C. Pollock to file an application for a review of the case and this application was scheduled to be heard March 30. The convicted men are residents of Iowa, Nebraska, Missouri, Illinois, Michigan, Indiana, Wisconsin and Minnesota. Some of them are officials of the National Association of Master Plumbers and of State organizations of that body. It was charged in the indictments that the association has been operating in violation of the Sherman law ever since its organization in 1884, and that it had conspired to interfere with the business of plumbers and plumbing supply houses not members of the association. In the trial the prosecution proved the conspiracy charge by resolutions alleged to have been passed at meetings of the association in Baltimore, New Orleans, New York and Cleveland and by testimony of former employes of the association and men who said they had suffered from the activities of the organizations.

Hastings, Neb.—Resolutions were adopted at a recent meeting of business men of Hastings urging the mayor and city council to look into the proposition of establishing a central steam heating plant in connection



Johnson Sylphon Valve

in which the RUBBER diaphragm is replaced by the METAL SYLPHON BELLOWS, which will not vulcanize, crack and leak, reducing the repairs to a minimum and increasing the efficiency and desirability of the Johnson System of Automatic Temperature Regulation.

Write for Booklet.

Johnson Service Company

MILWAUKEE, WISCONSIN

NOTICE—We are the owners of Patent No. 924,235 relating to the automatic control of humidity. Infringers and unlicensed users will be prosecuted.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

The Webster System of Automatic Humidity Control

is readily applied to the various types of

WEBSTER AIR WASHERS

It is perfect in principle and accurate in operation.

It possesses features that make it both practical and simple, among which may be mentioned:

1. Separate control, by ordinary thermostats, of the average dry and wet-bulb temperatures of air leaving the Air Washer.
2. Independent of unequal air and spray distribution and temperature, ordinarily causing unequal humidification, supersaturation, inaccurate results, etc.
3. Quick response—the chief controlling thermostat subject to water, a medium with four times the specific heat of air.
4. Inherently safe against over humidification.

Send for catalogue "C"— 88 pages of valuable information
Consult us regarding Air Conditioning Apparatus for any purpose

WARREN WEBSTER & COMPANY, CAMDEN, N. J.

Established 1888 **Branches in Principal Cities**

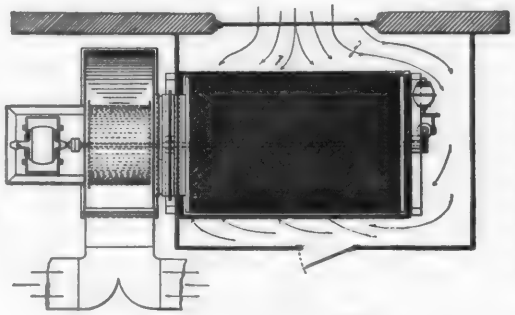
Kingwelton Talks No. 3.

SIMPLICITY IS THE WATCHWORD

in the construction of the

KINGWELTON ROTARY AIR PURIFIER

This apparatus consists of a revolving drum, encased with a fabric of suitable mesh and weave, through a water bath, at any desired speed.



The air is taken through the mesh into the interior of the drum and the washed and purified air withdrawn therefrom by the usual blower or exhauster used for heating and ventilating purposes.

Patented April 13, 1912
Plan View

These washers are made by us in dimensions to fit any reasonable location, and to purify any desired volume of air. Upon request we will gladly inspect any premises in which ventilation of this character is desired and will furnish estimate therefor.

Send for descriptive circular, giving lists of typical installations.

WELLS & NEWTON CO., Ave. B and 17th St., New York

with the present municipal light and pumping plant. It is estimated that such an installation will cost $35,000. The meeting at which the resolutions were adopted was addressed by Hal C. Kimbrough, of the Chicago branch of the American District Steam Company, who showed the possibilities of such a system, from an economical standpoint, in spite of the fact that it would involve about a mile of underground piping from the power plant to the business district.

Chicago, Ill.—A "community" heating plant to supply heat to four homes at the north end of Lincoln Park is being planned by as many wealthy and socially prominent families in connection with a group of new residences they are building at that point. The originators of the idea are Frederick C. Bartlett, 2901 Prairie Avenue; Ambrose Cramer, of Cramer & Willing, Lake Forest; Abram Poole, George F. Porter, 26 East Erie Street, and Mrs. Arthur Ryerson, 716 Rush Street. The project involves other schemes for economy in the matter of living expenses. The land on which the community homes will be built is on Lake View Avenue, just south of Diversey Boulevard. In addition to the common heating plant, the members of the colony will have a community garage.

New York.—The Broadway Association's subway ventilation committee, which has been active in opposing the use of sidewalk gratings as outlets for the subway ventilating system, is raising a fund of $20,000 to carry on the campaign. The matter has been brought to a head by the installation by the contracting company of a grating at Broadway and 24th Street. The alternative plan proposed by the Broadway Association is the location of air outlets in the public squares and parks, with connecting air ducts placed either directly underneath the trolley conduits or in hollow curbs with sunken gutters. The objections to the gratings in the sidewalk are that they menace health, reduce the sidewalk space, depreciate property values and drive pedestrians from Broadway.

Columbus, O.—Street car and interurban companies will be required to furnish heat in the vestibules of their cars for motormen and conductors, if Governor Willis approves the bill by State Senator Smith of Butler County, which has been passed by the legislature.

Great Falls, Mont.—Steps have been taken

Tycos Temperature Instruments

The *Tycos* Mercury Operated Recording Thermometer

H & M Type Thermometers

Tycos Mercury Operated Steel Construction Recording Thermometers

Automatic Temperature and Pressure Regulators

All Glass Engraved Stem Thermometers

Hygrodeiks and Hygrometers

Thermo Electric and Radiation Pyrometers

H&M Tycos

The H&M Division

Taylor Instrument Companies

Rochester, N.Y.

H & M Type Straight Thermometer with Thread Connection

STURTEVANT AIR WASHERS IN THE MINNEAPOLIS POST OFFICE

In the Minneapolis Post Office are two Sturtevant Air Washers of capacities 20,300 c.f.m. and 34,800 c.f.m. Larger washer with recirculating pump and motor is shown in centre of illustration.

The Sturtevant Air Washer

REG. U. S. PAT. OFF.

has been adopted by leading architects and engineers by reason of inherent mechanical and operating advantages. Simple, compact, and efficient, it is used wherever air is to be conditioned.

Sturtevant tempering coils, heaters and fans were also used in this building.

There's a book describing Sturtevant Air Washers in full. Ask for catalog 225-V.

B. F. Sturtevant Company

Hyde Park, Boston, Mass.

AND ALL PRINCIPAL CITIES OF THE WORLD

by the city council of Great Falls toward the installation in that city of a central heating plant. A proposition was submitted by E. H. Dalbey and C. B. Lockart urging that the matter be referred to the freeholders of the city at the general city election for the granting of a franchise. This would have to be done through a special election. The proposition was referred to the public improvement committee of the council.

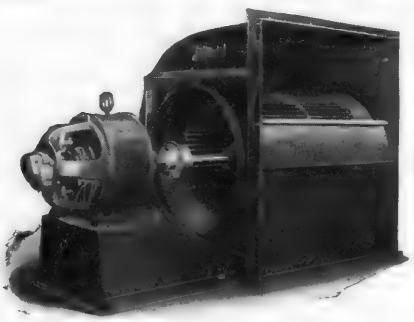
Maine Plumbing, Steam and Metal Salesmen's Association held its annual meeting at Riverton Casino, Portland, March 8. Officers were elected as follows: President, Shirley R. Mitchell, Walworth Mfg. Co., Boston; first vice-president, J. M. Griffith, Thomas Durkee Co., Boston; second vice-president, F. S. Billings, Richards & Co., Boston; third vice-president, H. S. Wakely, H. W. Johns-Manville Co., Boston branch; financial secretary, W. F. Snow, J. L. Mott Iron Works, Boston branch; recording secretary, Ellsworth F. Hayden, Smith & Abbott Co., Portland, Me.; treasurer, A. M. Rosebrooke, Gurney Heater Mfg. Co., Boston. As usual the feature of the meeting was the dinner in the evening at which a topical poem was rendered by A. E. Campbell, the retiring president.

Manufacturers' Notes.

Sarco Engineering Co., New York, manufacturer of the Sarco steam traps, Sarco vacuum valves and Sarco temperature regulators, has moved to new and larger quarters in the South Ferry Building, 1 State Street, New York. The company reports substantial continued increases in its business during the past half year, in spite of the influence of the European war.

Terry Steam Turbine Co., Hartford, Conn., announces that its Chicago office is now in charge of A. W. de Revere. This office is located in the People's Gas Building. The company also anounces that it has opened an office in Grand Rapids, Mich., in the Michigan Trust Building, with A. L. Searles in Chicago.

Buffalo Forge Co., Buffalo, N. Y., reports the following as some of the new public buildings in which Buffalo heating and ventilating aparatus will be installed: Chemistry Building, University of Illinois; Hebrew Technical School, New York; Kern Country High School, Worcester, Mass.; Bryan Mullanphy School, St. Louis; First Baptist Church, Sherman, Tex.; Children's Hospital, Philadelphia; Ames Building,



Reasons Why

You should specify---

"Sirocco"
TRADE MARK.

Multi-Blade Fans and Blowers

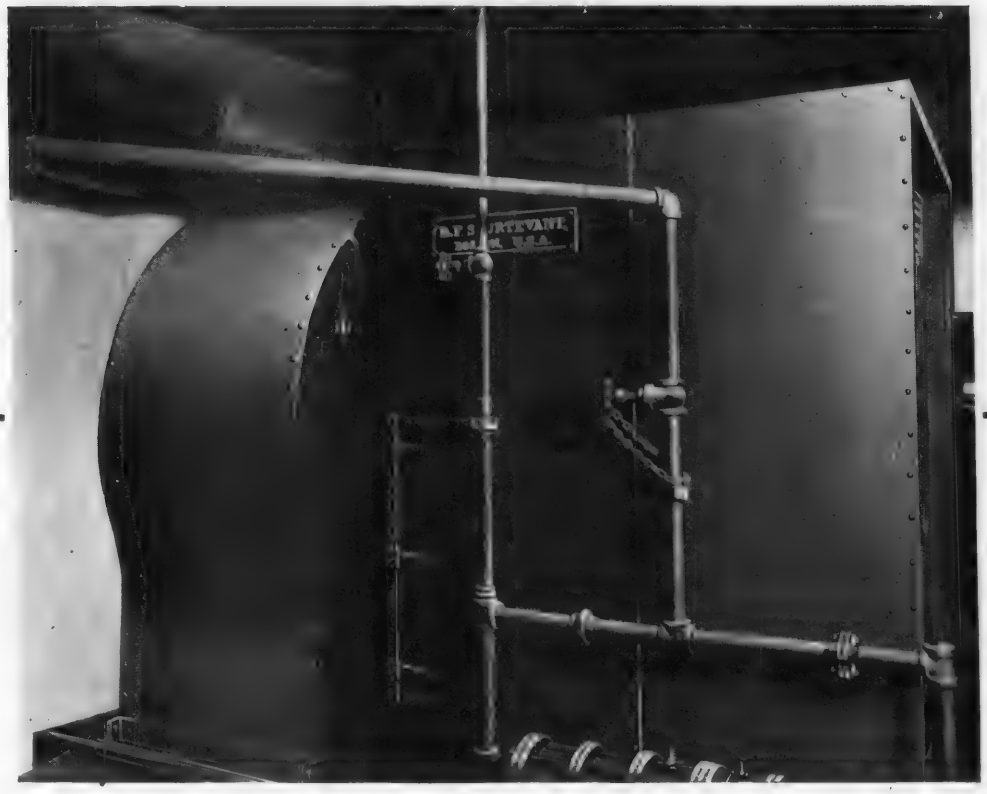
1. **Because** they handle twice as much air, consuming less power than paddle wheel fans of same wheel diameter.
2. **Because** their design makes it possible for every bit of energy consumed; produce the maximum amount of air.
3. **Because** their high mechanical efficiency keeps their upkeep costs down to the minimum.

Bulletin No. 109 will be mailed at your request.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN, U.S.A.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



Sturtevant Hot-Blast Heater at the Pettebone-Cataract Paper Co., Niagara Falls, N. Y.

Over 20 Years of Leakless Operation

It is more than 20 years since we installed this hot blast heater and as yet it has not developed a single leaky joint.

The fact that a heater has run 20 years is no surprise to us. We have dozens of installations exactly like it.

Sturtevant apparatus is built to give lasting satisfaction. Only the most suitable materials are used and great care is taken in every detail of manufacture. You take no chances if you install it.

Sturtevant Engineers are always willing to work with you and to help you with laying out any work you have on hand.

B. F. Sturtevant Company

Hyde Park, Boston, Mass.

AND ALL PRINCIPAL CITIES OF THE WORLD

Sturtevant

(REG. U. S. PAT. OFF.)

Cleveland, O.; Baltimore Hotel, Kansas City, Mo.

Magee Furnace Co., Inc., Boston, Mass., is the title of the reorganized firm of the Magee Furnace Co., whose failure was announced some time ago. The new interests are represented by Robert L. Walker Co., of Providence, R. I., and Alfred E. Stockbridge, of Somerville, Mass. Mr. Stockbridge will be the general manager of the company. The final papers effecting the transfer were signed February 5 in the United States Bankruptcy Court by William L. Quimby, of Brookline, Mass.

United States Radiator Corporation, Detroit, Mich., held its annual convention at the Hotel Tuller, in that city, February 10-13. The annual banquet was held on the evening of February 11. Twenty-six plant and branch managers were present, including A. H. Rose, New York branch; W. H. Thayer, Boston; J. A. Gurney, Pittsburgh; E. L. Downe, Detroit; Warren S. Hillis, Chicago; Paul V. Rosier, Omaha; A. H. Joloffe, Kansas City; George W. Barr, Philadelphia; E. A. Stark, Cleveland; H. J. Warneke, Minneapolis; F. H. Blackmore, Edwardsville, Ill.; J. A. Venable, Geneva, N. Y.; J. F. Geary, West Newton, Pa.; M. H. Stimson, Dunkirk, N. Y., and H. G. Naylor, Paola, Kan.

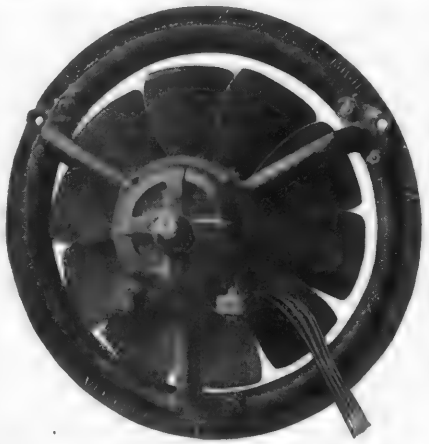
Pierce, Butler & Pierce Mfg. Corporation, Syracuse, N. Y., announces that R. J. Kingsbury, formerly with the Koalsave Vacuum Valve Co., New York, has joined the sales force of the company's New York branch.

American Radiator Co., Chicago, reports a net profit in its earnings over those of the previous year ending January 31, 1915, of $207,808. The earnings were equal to 25.42 per cent. on the common stock, compared with 25.14 per cent in 1914. The financial statements follow:

OPERATIONS.

	Yr. ended Jan. 31, 1915.	Yr. ended Jan. 31, 1914.	Yr. ended Jan. 31, 1913.
Net Profits.	$2,289,075	$2,081,267	$1,696,193
Div. on pfd.	210,000	210,000	210,000
Balance.	$2,079,075	$1,871,267	$1,486,193
Div. on com.	1,655,680	1,393,590	1,266,900
Surplus .	$423,395	$477,677	$219,293
Earn., com.	25.42	25.14	21.95

The combined net profits of the parent and foreign company for the fiscal year were $2,784,741, showing earnings of 31.45% on the common stock, after paying 7% on the preferred stock. During 1914 $911,580 in



Westinghouse-Ventura
Ventilating Fans

possess the following special features:

High Efficiency—Note the special construction of the fan. This design, together with the high electrical efficiency of the motor, insures the movement of the maximum amount of air for a given amount of power consumed.

Quiet Operation—Suitable for use in churches, hospitals, etc., where noise would not be tolerated.

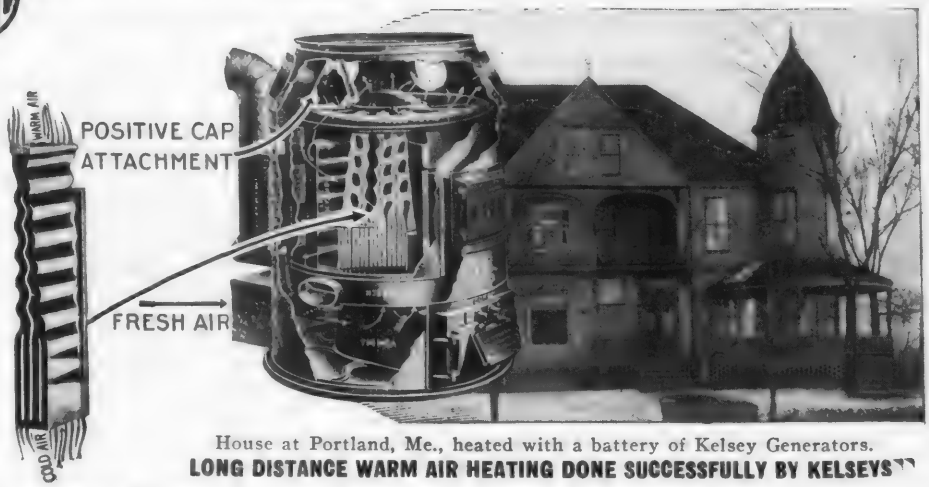
Little Attention Required—An occasional inspection of the motor and lubrication of the bearings is the only attention necessary.

Enclosed Motor—Motor is completely enclosed and protected from dirt, steam, etc.

Compactness—Motor projects but little into the room when fan is installed in wall.

Made in sizes of from 18¾ to 32 inch wheel diameter. Send for publication, giving full description, capacities, dimensions, prices, etc.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.



House at Portland, Me., heated with a battery of Kelsey Generators.

LONG DISTANCE WARM AIR HEATING DONE SUCCESSFULLY BY KELSEYS

Don't you think for a minute that because Kelsey Heat is a warm air heat, that it can't be successfully carried long distances. It can.

In ex-Governor Murphy's house at Mendham, N. J., one of the cellar ducts is 50 feet long and the room is satisfactorily heated by gravity in any weather with the wind blowing from any direction.

Speaking of long distance heating, have you any church or school jobs in prospect, where a Kelsey Gravity or Fan System could be installed?

We have been doing a lot of them this past year, the particulars of some of which might help you a good bit.

Bear in mind that we are always ready to help you on any of your jobs.

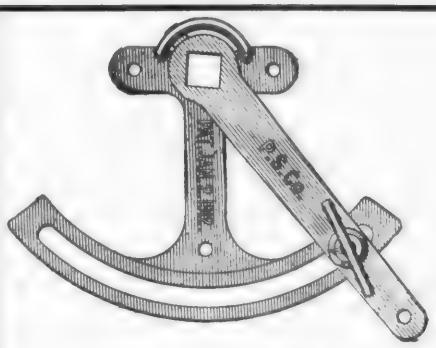
You can make both money and friends on your Kelsey installations. Write us.

THE KELSEY
WARM AIR GENERATOR

New York, 103 F Park Ave.

Syracuse, N. Y., 303 James St.

Dealers in all Principal Cities



Specification

"Furnish and install, in all heat and vent flues, adjustable Dampers and, in all branch ducts, movable Deflectors equipped with Parker Damper Quadrants (manufactured by the Parker Supply Company, 515 West 45th Street, New York City), which permit of the Dampers and Deflectors being held in any desired position."

The net result of making the above a part of your damper specifications is 100% damper regulating efficiency—maximum satisfaction. For

Parker's Damper Quadrant

is conceded by Engineers and Sheet Metal Workers, alike, to be the simplest, neatest and most efficient device for controlling dampers and deflectors.

It has only two parts—lever and frame. And the lever locks right onto the frame, doing away with the need of drilling and the use of pins, springs, nuts, bolts, etc. Result: a better and neater job.

The Quadrant is in use in some of the world's greatest and costliest buildings—the Woolworth, the Municipal and the Hudson Terminal in New York; the Bellevue-Stratford Hotel in Philadelphia; the Technical High School in Jersey City; the Bureau of Engraving and Printing Building in Washington and scores of others as prominent.

We have a booklet which illustrates and describes it in detail. May we send you a copy for your files?

PARKER SUPPLY COMPANY

Manufacturers of Engineers' and Sheet-Metal Workers' Specialties

515 WEST 45th STREET NEW YORK

cash and $744,100 in stock were paid out as common stock dividends. In 1913 the cash payment was $717,090 and the stock $676,500, while in 1912 the cash amounted $651,900 and the stock distribution $615,000.

BALANCE SHEET—ASSETS.

	1915.	1914.
Real estate, etc.	$11,937,607	$11,700,223
Depreciation	300,000	300,000
Net plant	$11,637,607	$11,400,223
Cash	3,769,463	2,793,122
Notes receivable ..	267,406	312,023
Acounts receivable.	1,430,804	1,778,426
Material, product..	2,128,073	1,996,940
Total quick assets	$7,595,747	$6,880,511
Total assets	19,233,354	18,280,735

LIABILITIES.

Preferred stock	$3,000,000	$3,000,000
Common stock	8,185,600	7,441,500
Accounts payable...	920,169	1,135,044
Surplus account.....	7,127,585	6,704,190
Totals	$19,233,354	$18,280,735

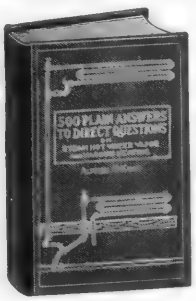
In his annual report President Clarence M. Wooley states that because of high interest rates which restricted new building enterprises in 1914, the company made greater efforts to obtain contracts for placing modern heating systems in old buildings and that that class of business has become an important part of the total demand.

Crane Co., Chicago, Ill., elected the following officers at its recent annual meeting: President, R. T. Crane, Jr.; first vice-president, J. B. Berryman; second vice-president and treasurer, A. D. MacGill; secretary, E. H. Raymond; assistant secretary, C. D. Little. Announcement is made by the company that its Los Angeles branch is now in charge of E. H. Hunt, for many years assistant Chicago manager. Mr. Hunt succeeds Jud Seager, who has tendered his resignation on account of ill health.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y., has completed the occupation of its new plant at Berry and South Fifth streets. The company's new plant is a concrete structure of modern design, and is fireproof. The building comprises seven floors, with an area of 10,000 sq. ft. to each floor, making 70,000 sq. ft. in all. The complet manufacturing organization, as well as the home office of the company, is now located in these new quarters, which are easily accessible from the Brooklyn end of the Williamsburg bridge. The Schaeffer &

Here is a Book You Will Want

500 PLAIN ANSWERS TO DIRECT QUESTIONS



ON

STEAM, HOT-WATER, VAPOR AND VACUUM HEATING

By ALFRED G. KING

Author of "Practical Steam, Hot Water Heating and Ventilation" and "Practical Heating Illustrated," Etc., Etc.

214 Pages. **Price, $1.50** **127 Illustrations.**

A practical treatise consisting of 24 chapters. It answers questions regarding each method or system that would be asked by the steam fitter or heating contractor. The answers are given in easily-understood language, and are based on many years of experience. Address

Heating and Ventilating Magazine Co., 1123 Broadway, New York

The Standard Work on Mechanical Cleaning

Vacuum Cleaning Systems

By M. S. Cooley

Mechanical Engineer, Office of Supervising Architect, Treasury Department, Washington, D. C.

244 pages, 6 x 9 inches. 105 Illustrations. 20 Tables.

Price, postpaid, $3.00

The first full and authoritative treatise on the art of vacuum cleaning. Contains all of the author's important tests of vacuum cleaning apparatus, history of mechanical cleaning, requirements of an ideal vacuum cleaning system, together with chapters on the carpet renovator, other renovators, stems and handles, hose, pipe and fittings, separators, vacuum producers, control, scrubbing systems, selection of cleaning plant, tests, specification and portable vacuum cleaners.

A Book for Engineers, Architects, Superintendents of Buildings, Heating and Plumbing Contractors and Others Interested in the Correct Design and Installation of Mechanical Cleaning Plants of Any Type.

Published by the

Heating and Ventilating Magazine Company

1123 Broadway, New York

Budenberg Mfg. Co. is the United States branch of a world-wide organization, having manufacturing branches in almost every country in the world. In many of its European factories upwards of 5,000 hands are employed. The United States branch was established in 1878, over 37 years ago. The company's main office, which occupies 5,000 sq. ft., contains an exhibition room of its line of testing instruments and testing apparatus. The company manufactures a complete line of thermometers, gauges, recording gauges, recording thermometers, counters, time recorders, recording and indicating tachometers, electric pyrometers, steam, oil and gas engine indicators, steam calorimeters, gauge testers, as well as other instruments for similar uses.

Richmond Radiator Co., New York, has issued its report for the year ending December 31, 1914. The surplus at the end of the year, it will be noted, is $63,367, as compared with $146,989 a year ago. There is provided, however, in the 1914 statement, a reserve of $10,310 which did not appear in the statement for the year 1913. The balance sheet follows:

ASSETS.

	Yr. ended Dec. 31, 1914.	Yr. ended Dec. 31, 1913.
Cash	$221,686	$228,677
Accounts receivable	263,634	260,632
Bills receivable	110,503	113,833
Merchandise	526,184	642,071
Mtgs. and securities	5,820	5,870
Real estate, etc.	866,905	848,075
Prepaid insurance	10,975	6,234
Pref. voting tr, ctf.	3,422	3,423
Patents, etc.	2,811,856	2,811,857
Total	$4,820,990	$4,920,672

LIABILITIES.

Accounts payable	$13,563	$20,683
Accrued wages	4,319	.....
Mortgages payable	2,500	28,000
Accrued taxes	1,929	.....
Preferred stock	1,575,000	1,575,000
Reserve	10,310	.....
Common stock	3,150,000	3,150,000
Surplus	63,367	146,989
Total	$4,820,990	$4,920,672

The statement does not show anything relative to the paymend of dividends.

MOUAT Graduating Vapor Heating System

Offer Your Trade Advantages They Cannot Get Elsewhere

When you go out to sell a Mouat Vapor Heating System, you can offer your customers not only the highest quality equipment, but a number of most desirable advantages that cannot be obtained in any other heating system.

Heat when it is wanted, where it is wanted, and in just the right amount—independent heat regulation in each room—expense stopped when radiator is shut off—these are some of those advantages.

You know what it means to offer your customers something they want that they cannot get elsewhere.

Write today for Booklet.

THE MOUAT-SQUIRES CO.

1244 W. 4th Street
CLEVELAND, O.

MILD HEALTHFUL HEAT
When You Want It
Where You Want It
In Just the Right Amount

Maintaining a Predetermined Boiler Pressure to the Ounce

Together with a perfect Modulating Vapor Valve and absence of all mechanical devices make the

HUTCHISON VAPOR HEATING SYSTEM

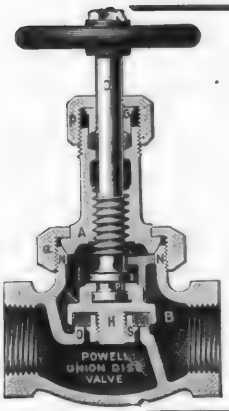
the best ever produced

Simplicity -- Accuracy -- Economy -- Low Cost Installation

Use Letter Head and Write for Further Information

HUTCHISON VAPOR HEATING CORPORATION, WOODWARD BLDG., WASHINGTON, D. C.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



POWELL VALVES

FOR HOT WATER OR STEAM HEATING

Five Points of Efficiency Combined in the POWELL Union Composite Disc Valves

1. Body symmetrically designed and well-proportioned. 2. Metal distributed to meet most wear 3. Union bevel ground joint connection between body and bonnet, red lead or cement unnecessary to make them tight. 4. Disc-holder "H" permits the use of any make of rubber discs. 5. All parts made to gauge and are interchangeable.

Ask your dealer for "POWELL" VALVES or write us.

THE WM POWELL CO.

DEPENDABLE ENGINEERING SPECIALTIES

CINCINNATI, O.

STANDARD
Steam Pipe Casing

Above cut illustrates the completion of our tin lined

STEAM PIPE CASING

We also make unlined casing.

FOR

Insulating Underground Steam Pipes

Write for CATALOG and PRICES.
We furnish all SPECIALS required.

Standard Wood Pipe Co.

Williamsport, Penna.

STEEL TANKS

For All Purposes

Riveted Tanks
Welded Tanks
Brazed Tanks

Founded 1802- -112 Years Old

Wm. B. Scaife & Sons Co.

NEW YORK OFFICE
26 Cortlandt Street

Pittsburgh, Pa.

BETWEEN THE TWO COVERS OF

Scientific Building Operation

you will find a half hundred articles written by the best authorities on building management in this country. Here are some of the subjects:

RENTING—ACCOUNTING—REPORTS—OPERATION METHODS—OPERATING COSTS PURCHASING SUPPLIES—ELEVATORS—LIGHTING—INSURANCE—FLOOR LAYOUTS

Our special price to subscribers of **Buildings** and Building Management is $2.00 delivered to you. Otherwise, $2.50. Buildings and Building Management for one year and Scientific Building Operation, $4.00.

PATTERSON PUBLISHING CO., 918 City Hall Square Building, Chicago

Buffalo Forge Co., Buffalo, N. Y., reports the following additional contracts for heating and ventilating apparatus in public buildings:

Private Ward Hospital, Wilkes-Barre, Pa.; Southwark Public School, Philadelphia; Merchants' National Bank, Richmond, Va.; Union High School, Alhambra, Cal.; High School, Compton, Cal.; El Paso Telephone Co., El Paso, Tex.; Public School, Garden City, S. D.; Concordia Club, San Francisco, Cal.; Bloomsburg Church, Bloomsburg, Pa.

Sims Co., Erie, Pa., reports that since the first of the year installations have been made of over twenty Sims B/H Type Clean E-Z heaters in apartment houses in New York City, for heating water for domestic purposes. On account of the superiority of this type of heater to the tank and coil type, the company states that they are being accepted as standard by architects and engineers.

Gurney Heater Mfg. Co., Boston, Mass., announces that the Harris Pump & Supply Co., 319-321 First avenue, Pittsburgh, Pa., has taken the selling agency for the Gurney steam and hot water heaters and radiators for the Pittsburgh territory. It is further stated that the Harris company, through its organization, is in a position to serve the trade efficiently and promptly.

New Firms and Business Changes.

O. S. Kendall & Sons, Worcester, Mass., the well known heating and plumbing contracting firm, has been dissolved. Since the death of O. S. Kendall, a year ago, the business has been conducted by his son, O. S. Kendall, Jr. Negotiations which were in progress to sell the business to Chicago parties were not consummated.

Albert & Frost, Fairmont, Minn., is the title of a new heating and plumbing firm in that city, composed of W. F. Frost and E. L. Albert.

L. B. Marks and J. E. Woodwell, New York, consulting engineers, will dissolve partnership May 1, next. Mr. Woodwell will thereafter be located at 8 West 40th Street, where he will continue his practice as consulting engineer, and Mr. Marks will retain his present quarters at 103 Park Avenue, specializing in illuminating engineering.

New Incorporations.

Lukomski Bros. Co., Detroit, Mich., capital $30,000; to conduct a heating and plumbing business. Principal stockholders: Anthony, John, Stanislaus and Frank Lukomski.

Harrison Plumbing, Tinning & Heating Co., Little Rock, Ark., capital $10,000. Incorporators: C. V. Caster, J. O. Wilson and J. Clark.

E. M. Larsen Co., Madison, Wis., capital, $10,000; to conduct a heating and plumbing business. President and manager, E. M. Larsen; vice-president, S. G. Jordan; secretary and treasurer, E. M. Shealy.

Heat Regulator Co., Detroit, Mich., capital $3,000; to manufacture heat regulating devices. Principal stockholders: Fred R. Beaubin and Arthur Eddy.

Adams, Britz & Co., New York, capital, $20,000; to conduct a heating contracting business. Incorporators: P. Eliot Adams, Mamaroneck, N. Y.; Edwin Britz, New York, and Thomas Baumgardner, New York.

B. B. Sumpter Plumbing & Heating Co., Bowling Green, Ky.; capital $1,500. Incorporators: E. B. Sumpter, F. E. Curd and James D. Sumpter.

Michigan Warming & Ventilating Co., Saginaw, Mich.; capital $10,000; to manufacture and sell heating and ventilating apparatus and plumbing fixtures. Among the stockholders are Leroy G. Whitmer, Bloomington, Ill.; Harry D. Pearson, Cleveland, O.; and Fred D. Merry, Toledo, O. The main office of the concern will be in Saginaw.

Bohn & Clansky, Chicago, Ill.; capital $2,500; to engage in heating, plumbing and vacuum cleaning business. Incorporators: Fred J. Bohn, William W. Clansky and Otto W. Jurgens.

C. S. Wilmot Co., New York, capital $25,000, to conduct a heating, plumbing and electrical contracting business. Incorporators: C. S. Wilmot, Haddon Heights, and others.

Hoffman Heater Co., San Francisco, Cal., capital $25,000, to manufacture, sell and install water heaters and gas heating appliances. Incorporators: R. Hoffman, O. F. Ronsky, C. Nieding, B. F. Koch and C. C. Pease.

Bice-Ernest Co., Ann Arbor, Mich., capital $4,000, to manufacture and deal in heating, lighting and plumbing material and appliances.

Contracts Awarded.

J. J. Seibert and C. R. Danzinger, San Francisco, Cal., heating and ventilating Cafe Rex at Stockton and O'Farrell streets, for $5,060.

Bartlett Bros. Co., Cleveland, O., heating and ventilating West Austintown School at Austintown, for $4,100.

Holbrook & Martin, Atchison, Kan., heating and plumbing Masonic Temple building in Atchison, for $4,500.

Rautman Plumbing & Heating Co., Se-

attle, Wash., heating and plumbing Fischer Building on Third avenue, between Pike and Pine streets. Five stories. Contract price, $10,000.

J. C. Hurley & Co., Fresno, Cal., heating and ventilating New Washington Grammar School in Fresno for $12,836.

Pulte Plumbing & Heating Co., Grand Rapids, Mich., vacuum cleaning system in Ypsilanti High School at Grand Rapids.

Clark & Jones Heating and Ventilating Co., Lima, O., heating and ventilating new Grace M. E. Church in South Lima.

Frank Dupuis Co., Pawtucket, R. I., heating and plumbing Abbott street and Newport avenue schools in Pawtucket for $13,467.

Wichita Heating and Plumbing Co., Wichita, Kan., heating new high school building at Hutchison, for $12,000. A steam blast system will be installed.

Crain-Desmouroux Co., Springfield, O., heating and ventilating the E. L. Shuey factories building in Springfield.

Walker Electric & Plumbing Co., Rome, Ga., heating and plumbing Municipal Building at Rome (heating, $4,475, and plumbing, $2,470). A Reliable vacuum steam heating system will be installed. The electric work for this building, which will cost $100,000 when completed, went to the Rome Supply Co., at its bid of $2,030.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until April 20, 1915, for the construction complete, including mechanical equipment, etc., of the United States Quarantine Station at Portland, Me. Main building, two stories and basement, 7,300 sq. ft. ground area; storehouse, one story without basement, 1,100 sq. ft. ground area.

Until April 20, 1915, for the construction complete, including mechanical equipment, of the receiving building for the Philadelphia, Pa., Immigration Station at Gloucester, N. J. One story, frame construction, 29,000 sq. ft. ground area.

Until April 28, 1915, for the construction complete, including mechanical equipment,

The First Authoritative Handbook on District Heating

CENTRAL STATION HEATING

BY

BYRON T. GIFFORD

MEMBER AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS,
JUNIOR MEMBER AMERICAN SOCIETY OF MECHANICAL ENGINEERS

208 Pages, with 42 Figures, including 50 Pages of Miscellaneous Engineering Data

Size 6 x 9½ in., Bound in Flexible Leather

Now Ready for Delivery ***By Mail, Postpaid, $4.00***

This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used.

PUBLISHED BY THE

HEATING & VENTILATING MAGAZINE CO.

1123 BROADWAY, NEW YORK

etc., of the U. S. Post Office and Court House at Ardmore, Okla. Three stories and basement, 6,600 sq. ft. ground area.

Government Publications on Metric System Equivalents.

The Bureau of Standards is distributing a publication of interest and value to those engaged in foreign trade. This is a 68-page pamphlet entitled, "Units of Weight and Measure—Definitions and Table of Equivalents." Copies may be obtained free upon application to the Bureau of Standards, Washington, D. C. The table of equivalents relates to the translation from metric units to the customary units and from customary to metric.

Wanted.

POSITION WANTED.—Position wanted as designer or superintendent by engineer familiar with the design and installation of heating, ventilating and power plant work. Have been practicing as consulting engineer in the West for past four years and desire to return East. Will be at liberty about July 1. References. Address Box 15, care of Heating and Ventilating Magazine.

¾H.P.Equipment

Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

Send for catalogue

SPENCER TURBINE CLEANER COMPANY

HARTFORD, CT.

Dixon's Graphite PIPE JOINT COMPOUND

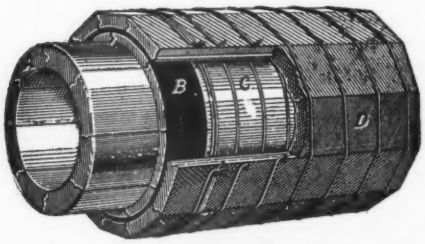
Is unequalled for all screw threads, nuts, bolts and studs—prevents rust joints.

Send for Booklet No. 211-D

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Co.

Established 1827



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

ELMIRA . . N. Y.

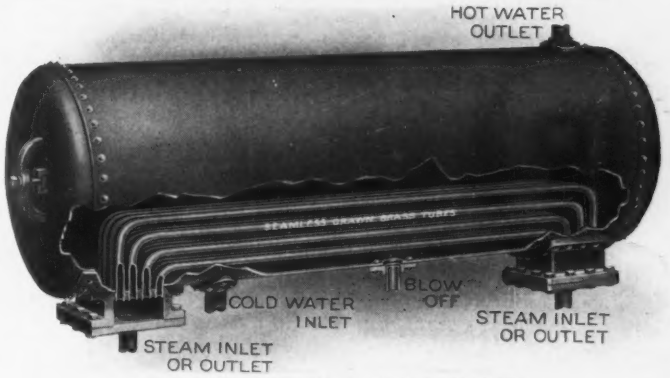
Chicago, Ill., 551 West 14th Place

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS

of the

PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

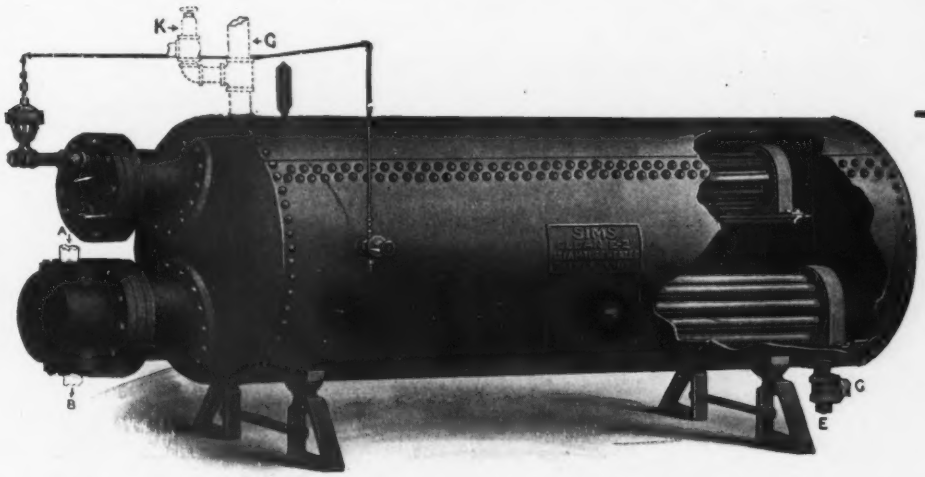


Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities Can be Furnished.
Send for Catalogue.

FRANK PATTERSON & CO., 26 Cortlandt Street, New York

Representatives in all Principal Cities



WHEN THE HOT WATER DEMAND RUNS HIGH

Our large experience in manufacturing heaters for laundries has developed the fact that there is not always enough exhaust steam to heat all the water to the temperature required. This is always the case with a wet-wash laundry. For a high hot water demand use the

SIMS CLEAN E-Z HEATER, TYPE D.

This heater is supplied with two sets of straight, seamless drawn brass tubes, the lower for exhaust steam, located in the coolest water. The upper set of tubes is for live steam direct from the boiler, controlled by a thermostat.

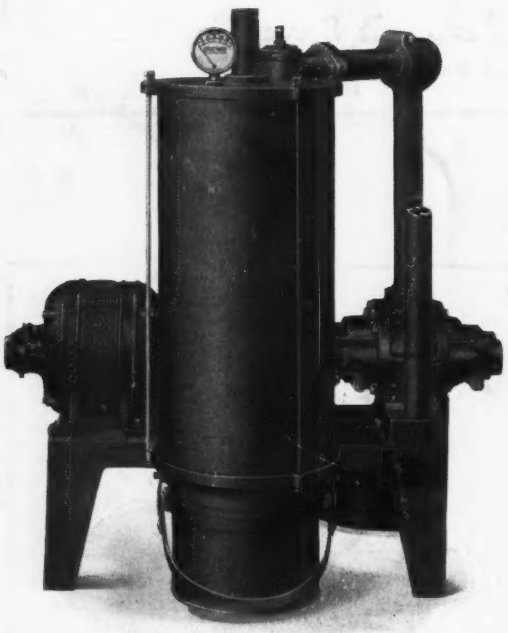
Our Bulletin HL-2 gives full particulars of Sims Heaters for laundries, hotels, hospitals and other service. Consultation free. All work guaranteed.

THE SIMS COMPANY **18th Street, Erie, Pa.**

A promising young sister

Formerly the ideal in architecture was mainly expressed in symmetrical proportions and harmony of detail. Today, the ideal is to make a building both handsome and highly accommodating to its occupants. In this upward trend of utility, radiator heating and modern plumbing, formerly luxuries and now necessities, have a young sister in stationary vacuum cleaning, a close follower in the line of building necessity. Modern buildings include this cleaning facility, or they fail to fully satisfy the owners, occupants, and tenants; so, it naturally interests modern engineers. For three years the

ARCO WAND VACUUM CLEANER



Front View of No. 341 Cleaner. Can be sold by Trade at $150—machine only

has been severely tested in homes, apartments, hotels, churches, schools, stores, theatres, auditoriums, garages, libraries, factories, etc. It is proving to be a ***reliable necessity***, wonderfully cutting down woman's labor, saving janitor expenses, insuring sanitary cleanliness, improving home-life. ARCO WAND Vacuum Cleaner lasts as long as building; and for all rented structures it insures satisfaction to tenants, right rentals to owners. No record of failures —every one made still giving satisfaction. If you have not tried it, put one in; your customer will thank you, for it earns satisfaction for all concerned in planning, equipping and using buildings. Your customers are cordially invited to visit our public showrooms and see the ARCO WAND at work.

AMERICAN RADIATOR COMPANY

Public Showrooms at Chicago, New York, Boston, Providence, Philadelphia, Washington, Baltimore, Rochester, Buffalo Pittsburgh, Cleveland, Cincinnati, Detroit, Atlanta, Birmingham, New Orleans, Indianapolis, Milwaukee, Omaha, Minneapolis, St. Paul, St. Louis, Kansas City, Denver, Seattle, Portland, Spokane, Los Angeles, San Francisco, Brantford (Ont.), London, Paris, Brussels, Berlin, Cologne, Milan, Vienna